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Cutting Grass Is Easy Work When Castings Help

POETS praise April showers as the herald of May flowers, but often do not mention that the warm rains of spring give renewed life to the grass that adds color to the summer landscape. About this time of the year, father must get the old lawn mower out of the basement, oil it and perhaps have it sharpened. Then starts the weekly task of keeping the grass to its proper height. If he is numbered

The Operator's Work Consists Merely of Guiding the Mower About the Lawn

among the less fortunate, he must visit the hardware store and spend some of the hard earned cash, or perhaps if he is a thrifty soul, borrow a mower from a neighbor. Since cutting the grass on the golf course green, in parks and large estates proved to be a costly job with the manually driven machine, power mowers have been developed. These drive either a single mower or several mowers attached to the power unit in tandem. Many of the parts used in the construction of lawnmowers are made in the foundry, and in the powered units, castings play an important part in the motor, etc. According to a report of the department of commerce, the value of lawn mowers manufactured yearly has increased from $2,848,119 in 1914 to $8,258,489 in 1923, the latest year reported. In 1923, Indiana led in the production with a value of $2,926,028 and Pennsylvania was second with a value of $1,382,358.

Find Where Castings Can Be Sold

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A. Van Ostade Thus Depicted the Alchemist in a Painting Made in 1661 and now Exhibited in the Peel Collection, National Gallery, London

FROM earliest times alchemists sought vainly for the famed philosopher's stone. This magic stone it was thought would transmute or change the baser metals like lead and iron to the noble precious metal, gold. Of course, the dream of these ancient seers never materialized. Although the grotesque experiments and weird incantations did not produce the magic touchstone, many of the strange attempts led to important practical discoveries. Indeed these crafty investigators laid the crude foundations of chemical science. Chemistry, which has wrought miracles never imagined in the wildest dreams of the alchemists, came into existence in the fifteenth century.

PHOSPHORUS

PHOSPHORUS is an element found in nature in many rocks and ores. Usually it occurs in some form or admixture of calcium phosphate. All iron bearing ores in this country contain these phosphates.

In the blast furnace all the phosphates are reduced to phosphorus and absorbed by the iron to form an iron phosphide. The phosphates enter the furnace as $Ca_3P_2O_8$, tricalcium-diphosphate and in the presence of silica, at slag forming temperature, probably release CaO to the slag leaving P_2O_5 free for reduction. This is accomplished probably by solid carbon and the phosphorus then is absorbed by the iron to form iron phosphide, Fe_3P. The complete reaction is as follows:

$$Ca_3P_2O_8 + 3\,SiO_2 + 5\,C + 6Fe = 3CaSiO_3 + 5CO + 2Fe_3P$$

The phosphorus is absorbed by the pig iron being formed. The lime unites with silica present in the ore to form slag. The carbon monoxide passes up the stack and assists in the reduction of the descending ore.

Since all the phosphorus in the ore is retained in the pig iron, it is evident that high phosphorus ores will produce high phosphorus pig irons and low phosphorus ores will produce low phosphorus pig irons. While high phosphorus cannot be lowered, low phosphorus ores can be made richer in phosphorus by adding phosphate rock to the charge. This expedient has been used by several furnaces using low phosphorus ores. If lower phosphorus is sought it is necessary to change to lower phosphorus ores. On the other hand low phosphorus ores can easily be enriched in this element, as was explained.

Basic, Bessemer and Foundry

Basic steel making processes, employing basic open hearth or basic electric furnaces are able to eliminate much of the phosphorus from the pig and stock charged. Phosphorus is an undesirable impurity in most steels.

These basic melting processes can make use of higher phosphorus pig iron, and for this reason higher phosphorus pig iron with silicon under 1 per cent commonly is called basic iron.

Acid bessemer, acid open hearth and crucible processes are unable to reduce phosphorus in the charge. Therefore, these processes can use only lower phosphorus pig irons. Such low phosphorus irons with silicon 1 to 1.5 per cent and phosphorus under 0.10 per cent are known to the trade as bessemer.

Thus the two great grouping of pig irons, basic and bessemer, depend on the phosphorus and silicon content of the irons. The bessemer grades are low phosphorus and the higher phosphorus grades are known as basic.

The line of demarkation for foundry irons formerly was sharply drawn. Irons under 0.30 phosphorus were not considered proper for foundry use. Today, irons under 0.30 phosphorus are used quite widely so that some bessemer and acid open hearth irons are finding practical foundry use, where lower silicon content is desired.

In cupola melting, the percentage of phosphorus in the molten metal is practically the same as the amount charged. As cupola melting is not strongly reducing, small amounts of phosphates in the fluxes and coke ash do not add to the phosphorus in the iron. However, the percentage of phosphorus in the mixture usually is slightly higher than that calculated from the charge. The reason for this is that no phosphorus is lost, while some of the iron, manganese and silicon are removed by oxidation. For example, in a charge containing 1.0 per cent phosphorus and an iron melting loss of 5 per cent, 100 pounds charge would have 1 pound phos-

Fig. 1—Alloy of iron and phosphorus. Phosphorus 1.8 per cent. Magnified 350 diameters. (Stead) Dark band is steadite structure. Fig. 2—*Alloy of iron and phosphorus. Phosphorus 8 per cent. Magnified 250 diameters. (Stead) Cellular portion is steadite*

One of the last of the alchemists, Hennig Brand, sought the philosophers stone through the evaporation of urine. About 1669 he produced some of this strange phosphorescent element called phosphorus.

In 1771, over a hundred years later, Scheele, a chemist, described the production of phosphorus from bone ash. Since that time phosphorus and its compounds have found many practical uses in phosphate fertilizers, in matches, in medicine and other industrial applications. In this and a succeeding article, the author who is technical director, Frank Foundries Corp., Moline, Ill. presents a study of the effect of phosphorus on gray iron.

Robert G. Guthries, Chief Metallurgist, Peoples Gas Light & Coke Co., Chicago, Has Photographed, in a Single Projection, Steel Magnified to 15,500 Diameters

Affects Qualities of Gray Cast Iron-I

By John W. Bolton

phorus and after melting, 95 pounds of metal still would have 1 pound or 1.053 per cent phosphorus. The trend of quality irons today is toward the lower phosphorus metals. Foundrymen have found that proper melting practice will give enough fluidity without using high phosphorus irons, as will be explained more fully later.

The influence of phosphorus on cast irons has been studied thoroughly. However, much of this information either is unavailable to the average foundryman, or is explained in so technical a manner that it is hard as Greek to understand. The writer has drawn freely upon technical literature for much of the data given here. However, remarks on the influence of phosphorus on the working properties of the casting are based largely upon his own experience and research in the metallurgy of iron.

Percy, an English metallurgist, carried out some of the first extensive studies of phosphorus in iron. In his book, *Metallurgy of Iron & Steel*, he lists a number of iron phosphorus compounds, varying from the formula Fe_6P to that Fe_3P_4.

An iron-phosphorus constitution diagram was prepared by Saklatwalla in 1908[1]. This is reproduced in Fig. 5. To those already familiar with the iron-carbon diagram this iron-phosphorus diagram will give little trouble. For others, an explanation will make the meaning clear. At point, *A* a start is made with 100 per cent pure iron, melting point 2750 degrees Fahr. As phosphorus is added to the metal, the melting point decreases rapidly. At point *B*, corresponding to 1.7 per cent phosphorus the solidification point is slightly under 2550 degrees Fahr. Dr. J. E. Stead[2] has conducted some notable microscopic researches on phosphorus forms. He found that from 0 to 1.7 per cent phosphorus no new crystal forms appear. The phosphorus dissolves completely in the iron, forming a solid solution. The only component showing under the microscope is ferrite, the crystal form of pure iron. Arnold[3] has shown that this iron or ferrite containing dissolved phosphorus is less ductile than pure iron. Others have shown that small amounts of phosphorus slightly strengthen pure iron and increase its hardness. These properties of increased strength, hardness and brittleness are characteristic of solid solutions.

[1]Saklatwalla—*Journal Iron & Steel Institute*, volume 2, 1908.

Forms Steadite

From point *B* to *C*, 1.7 to 10.2 per cent phosphorus, solidification points lower rapidly as the percentage of phosphorus increases. Also, a new component is found under the microscope. There is a small amount of it at 1.8 per cent phosphorus. This may be noted in Figs. 1, 2 and 3. This new honeycomb or cellular structure, 100 per cent in Fig. 3, is an eutectic of iron, Fe, and iron-phosphide, Fe_3P. It is fluid and melts around 1800 degrees Fahr. This, it should be noted, is several hundred degrees under the ordinary freezing point range of cast irons. Professor Sauveur proposed the name steadite for this eutectic, since Dr. Stead was the first to isolate and study it.

In iron with over 10.2 per cent phosphorus, diamond shaped crystals of the phosphide, Fe_3P, separate as shown in Fig. 4. There are also other crystal forms which are rich in phosphorus formed under certain special conditions. However, *in gray cast irons the only forms commonly found are the solid solution form and the cellular eutectic steadite.*

Irons containing over 0.50 phos-

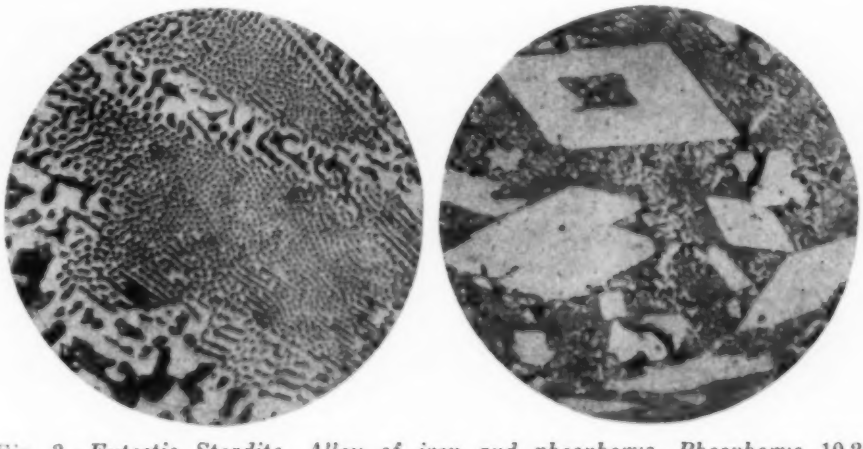

Fig. 3—Eutectic Steadite. Alloy of iron and phosphorus. Phosphorus 10.2 per cent. Magnified 350 diameters. (Stead). Fig. 4—Alloy of iron and phosphorus. Phosphorus 11.07 per cent. Magnified 60 diameters. (Stead) Diamond shaped plates of free phosphide Fe_3P

[2]Stead—*Journal Iron & Steel Institute*, 1900.
[3]Arnold—*Journal Iron & Steel Institute*, 1894.

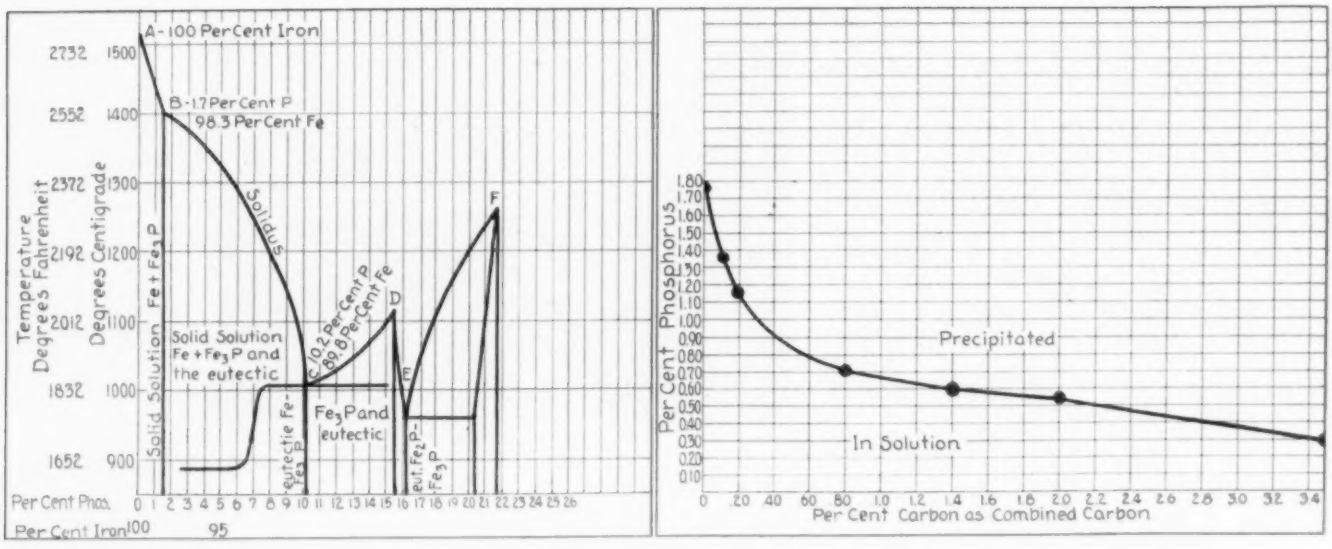
A-100 Per Cent Iron
B-1.7 Per Cent P
98.3 Per Cent Fe
Solidus
Temperature Degrees Fahrenheit
Degrees Centigrade
2732 1500
2552 1400
2372 1300
2192 1200
2012 1100
1832 1000
1652 900
Solid Solution Fe + Fe3P
Solid Solution Fe + Fe3P and the eutectic
C 10.2 Per Cent P 89.8 Per Cent Fe
D
E
F
Fe3P and eutectic
eutectic Fe-Fe3P
Eut. Fe2P-Fe3P
Per Cent Phos.
Per Cent Iron 100 95
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26
Per Cent Phosphorus
1.80 1.70 1.60 1.50 1.40 1.30 1.20 1.10 1.00 0.90 0.80 0.70 0.60 0.50 0.40 0.30 0.20 0.10
Precipitated
In Solution
0 .20 .40 .60 .80 1.0 1.2 1.4 1.6 1.8 2.0 2.2 2.4 2.6 2.8 3.0 3.2 3.4
Per Cent Carbon as Combined Carbon

Fig. 5—In the iron phosphorus constitution diagram above, the molten alloy is above and the solid metal below the line ABCDEF. The limit of solubility of Fe_3P in Fe is at 1.7 per cent. The eutectic steadite occurs at 10.2 per cent. Fe_3P reaches 100 per cent at 15.68 per cent and Fe_3P at 21.68 per cent

Fig. 6—The effect of carbon on solubility of phosphorus is shown in this diagram, which was plotted by Bolton from Stead's data

phorus commonly contain most of their phosphorus in the cellular eutectic or eutectic steadite formation. This form is illustrated in Fig. 7, a sample taken from a commercial iron. However, in lower phosphorus irons, the phosphorus formations do not assume the characteristic cellular eutectic form, but are structureless as shown in Fig. 8. The author[1] has shown this is due to formation of lower phosphorus alloys. There is sufficient ferrite or free iron so that the amount of phosphorus is insufficient to form the eutectic. We will call this alloy low phosphorus steadite.

Under high temperature annealing, above 1800 degrees Fahr., gray irons absorb both types of steadite crystals. This is illustrated in Fig. 9. The theoretical limit of such absorption is about 1.7 per cent phosphorus. In the case cited, the annealed iron is free from combined carbon and hence is all ferrite, graphite and steadite. The phosphide simply dissolves in the ferrite, forming a solid solution. This is just like the case in the alloy diagram, phosphorus dissolving in the pure iron, or ferrite formation, from *A* to *B*.

On the other hand sand cast irons practically free from combined carbon usually show crystals. This is because the balance of the ferrite was formed *below* the solidification point of the steadite.

The eutectic alloy, steadite, is extremely hard. Stead has shown its hardness is 5.5 on Moh's scale. Thus the steadite crystals are only slightly less hard than quartz sand. The writer examined a specimen of high phosphorus iron submitted by James T. MacKenzie, American Cast Iron Pipe Co., Birmingham, and found the brinell hardness was 418 for 4.8 per cent phosphorus. A photomicrograph of this specimen is shown in Fig. 10. The iron was not a white cast iron. Speaking approximately, steadite is 10 per cent phosphorus and 90 per cent iron. Its specific gravity is close to that of iron. Therefore, 1 per cent of phosphorus gives about 10 per cent of steadite by volume, that is 10 per cent of gritty grains.

It has been shown how, in pure iron phosphorus alloys, up to 1.7 per cent phosphorus is held in solution, giving rise to no steadite crystals. In a later paragraph it was stated that in commercial irons with over 0.50 per cent phosphorus content most of the phosphorus occurred in eutectic steadite crystals, these crystals presumably containing 10.2 per cent phosphorus. This may seem paradoxical to the careful reader. The reason for this behavior is that *combined carbon throws phosphorus out of solution.*

The quantitative effect is well il-

[1] Bolton, THE FOUNDRY, Oct. 1, 1922. Confirmed by Scheiber, Metallborse, 1923.

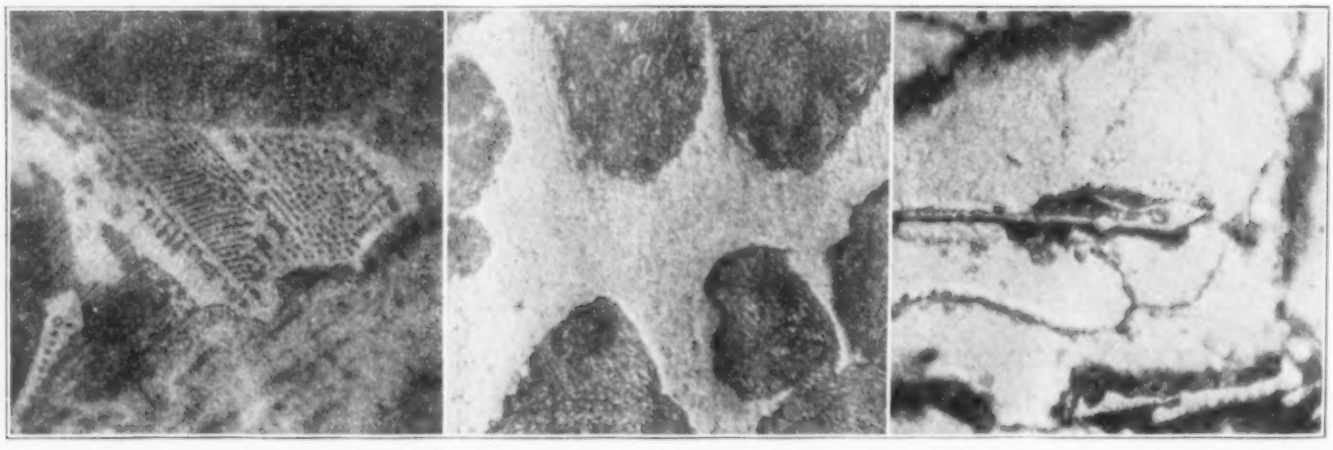

Fig. 7—Steadite in commercial iron x 735 dia., etched with bromine in amyl alcohol. This is the cellular or honeycomb eutectic structure. Fig. 8—Low phosphorus steadite in a commercial iron, etched with picric acid. Note absence of cellular structure. Fig. 9—Absorption of steadite, etched with picric acid. Thin white crystals are steadite, in process of absorption by surrounding ferrite

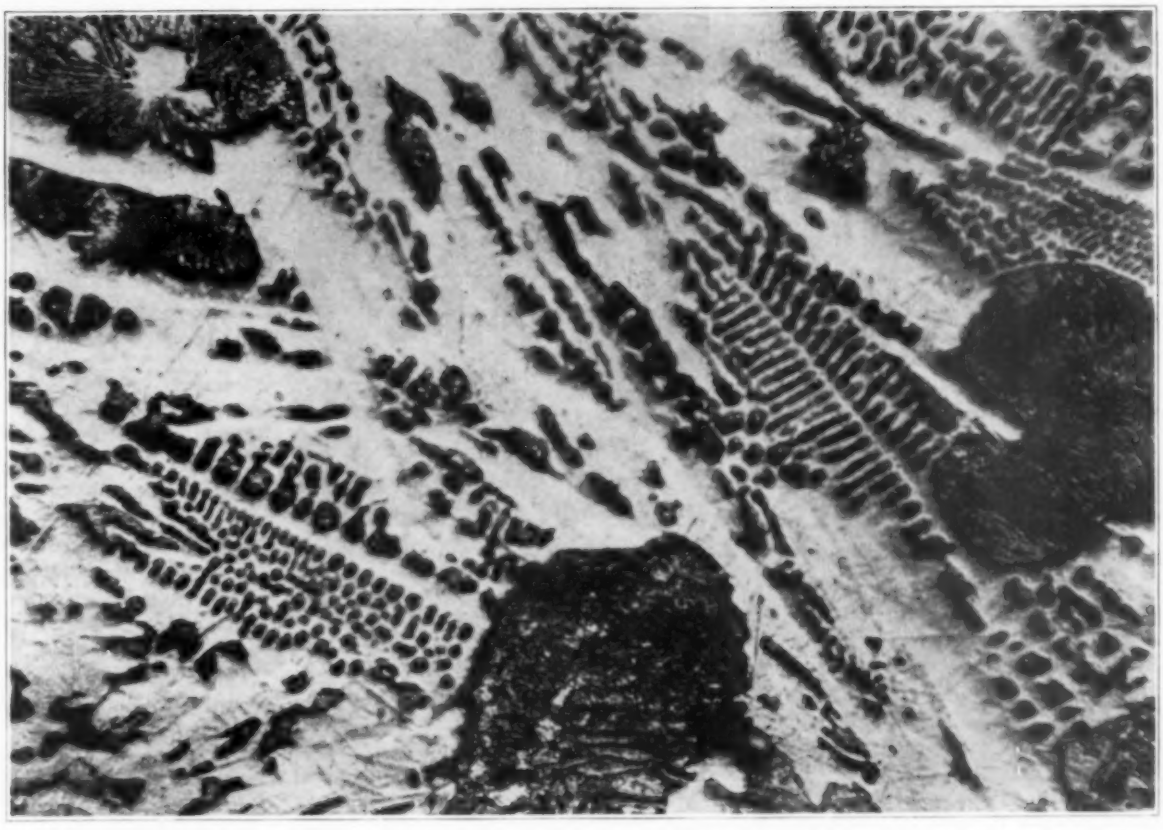

Fig. 10—White ground mass showing areas of cellular eutectic steadite. Magnification 1000 diameters, etched, picric acid. Phosphorus 4.8 per cent. Photomicrograph by Bolton. Sample submitted by Jas. T. MacKenzie

lustrated in the diagram, Fig. 6, plotted by the author from Stead's data.

It has been found that in white cast irons there is a ternary or three phase eutectic of iron, phosphorus and carbon. This eutectic contains 6.7 per cent phosphorus, 2.0 per cent carbon and 91.3 per cent iron. Rarely if ever is this found in gray irons. As pointed out by MacKenzie[5], if a ternary eutectic were found in gray iron, a sample with 0.30 combined carbon and 1.0 per cent phosphorus would contain no pearlite, a condition not checking with available microscopic evidence. Further, in some experimental work with MacKenzie, unpublished, it was noted that the percentages of total and graphitic carbon were nearly identical in irons completely graphitized at temperatures well under 1800 degrees Fahr. If there were a ternary eutectic, the graphite would have been considerably less than the total carbon.

One of the significant effects of phosphorus is its lowering of the iron carbon eutectic[6]. This eutectic occurs at 4.3 per cent carbon in pure iron carbon alloys. Fig. 11 is a chart plotted by the author and based on the date of Professor Wust. Inspection of the curve shows a gradual lowering of the eutectic up to about 0.5 per cent phosphorus, beyond which point there is an increased and steady rate of lowering. As the author has shown in an article in THE FOUNDRY, Oct. 1, 1922 that up to about 0.50 per cent phosphorus there are various amounts of phosphorus rich dendrites containing less than the 10.2 per cent

A

P	C
0.02	4.27
0.21	3.98
0.38	3.80
1.21	3.61
2.69	3.18
3.11	3.12
3.71	3.02
4.27	2.63
5.47	2.31
6.19	2.15
6.89	1.73
10.94	1.55
11.66	1.34
13.53	0.85
21.56	0.28

1306° Fahr and cooled slowly

B

P	C
0.02	4.27
0.27	4.22
0.28	4.04
0.83	3.98
2.34	3.34
3.27	3.29
3.94	2.88
4.61	2.41
5.89	2.24
6.55	2.14
8.17	1.89
11.72	1.36
13.90	0.80
21.56	0.28

at freezing point or just above for 1 hour.

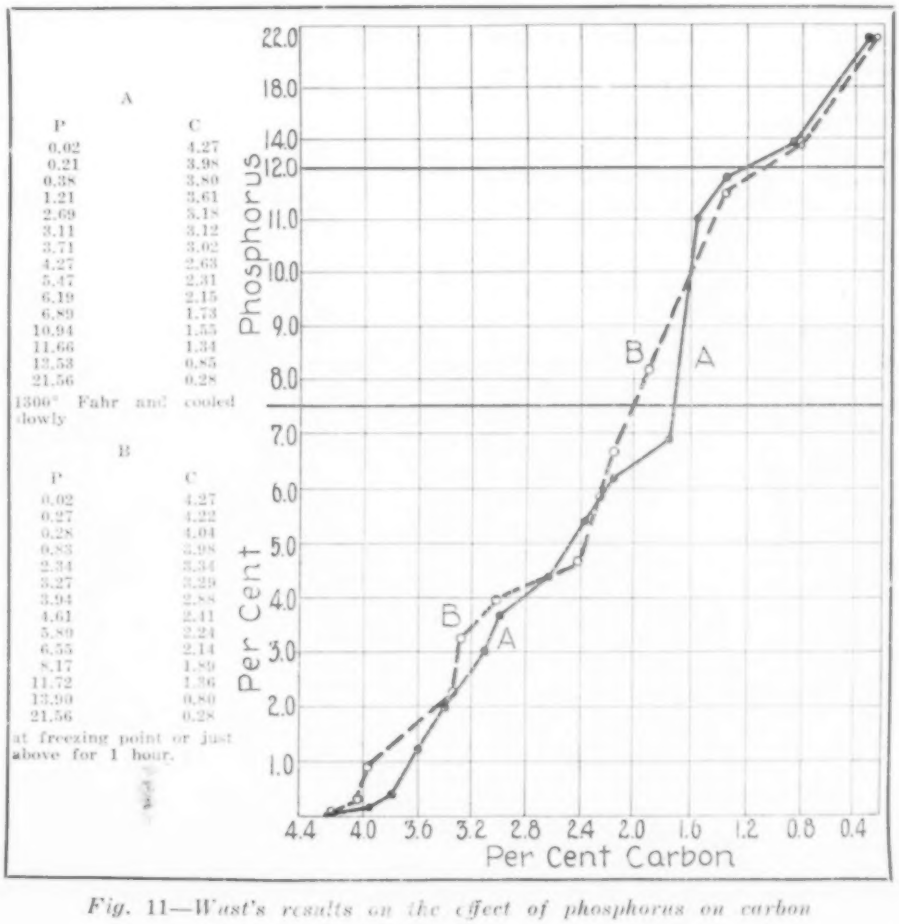

Fig. 11—Wust's results on the effect of phosphorus on carbon

[5]*Transactions American Foundrymen's Association*, volume 33, 1925—discussion of Fletcher's paper.

[6]An eutectic is the lowest melting point alloy of a series. It exhibits a fine uniform grain structure. Silicon also lowers iron carbon eutectic. Three per cent carbon for each per cent silicon. In irons with 2.5 per cent silicon the eutectic is somewhat under 3.55 carbon.

phosphorus of the eutectic steadite. Above 0.50 phosphorus most of the dendrites are the cellular eutectic type. This microscopic study on commercial irons checks with the laboratory work of Professor Wüst. If all steadite dendrites were of eutectic composition, 10.2 P, the carbon for the iron-carbon eutectic would be given by the formula:

Eutectic = 4.3 (1.0 — 0.10 P)[7].

This means that above 0.30 phosphorus some of the steadite dendrites are of the cellular eutectic composition, 10.2 P. At 0.50 P nearly all are present in this form[8].

Under hot-blast, coke furnace operation, pig irons usually contain the eutectic percentage of carbon. As all foundrymen have noted, high silicon irons generally have lower total carbon. Irons with 1.0 to 1.5 per cent silicon often have 3.9 to 4.0 per cent carbon, while irons around 3.5 silicon tend to have 3.0 to 3.25 carbon. As explained previously silicon also lowers the eutectic carbon concentration. Phosphorus has a similar action. In an excellent paper published in the *Transactions A. F. A.*, Vol. 33, MacKenzie has shown by exhaustive experiments that high phosphorus irons tend toward low total carbon. He suggests differences in properties between Northern and Southern irons may be due to this phenomena. One per cent phosphorus would lower carbon from blast furnace practice, theoretically, 0.2 per cent to 0.6 per cent. In cupola practice the effect is marked even less as irons are far under eutectic[9] concentration.

H. I. Coe has obtained cooling curves of irons containing increasing percentages of phosphorus. These are reproduced in Fig. 13. His results may be summarized as follows:

In irons from 0.09 to 2.90 phosphorus *the initial freezing point is lowered.* The author suggests this may be explained by assuming that as the volume of the phosphide structure increases the *concentration* of carbon in the remaining iron-carbon structure and hence lowers the freezing point.

The eutectic point is lowered.

The third or steadite solidification point *becomes more intense*, and raises slightly.

The fourth or recalescence point, *pearlitic transformation point remains practically constant.*

[7] *Transactions American Foundrymen's Association*, volume 33—discussion of MacKenzie's paper.

[8] Metallographists might note that these high phosphorus alloys, as illustrated in Fig. 12, are essentially mixtures of completely soluble in liquid and completely insoluble in solid type. The carbon of the micrograph is 1.85 per cent and phosphorus 4.8 per cent, iron made under saturation conditions. Theoretical carbon would be slightly over 2.0 per cent.

[9] When formed, hypereutectic irons rapidly lose their excess carbon as kish.

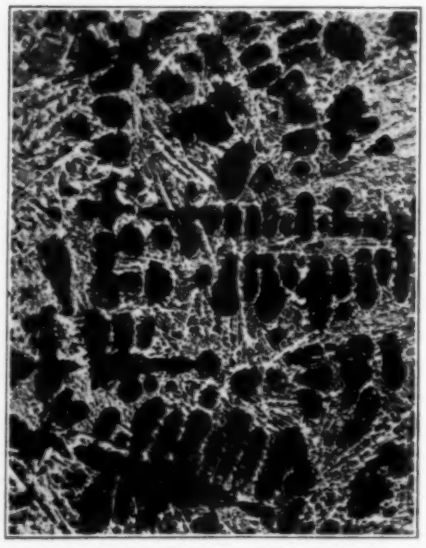

Fig. 12—Magnification 100 diameters. The phosphorus was 4.8 per cent, the carbon 1.85, silicon 0.09 and manganese 0.25, sample by MacKenzie

Wüst[10] has made a systematic investigation of the effects of certain elements on the shrinkage of pure iron. Up to 1.7 per cent phosphorus, in pure iron shrinkage is decreased. This is coincident with the limits of solid solution of phosphorus. Above 1.7 per cent, shrinkage again is increased. This is coincident with the formation of some of the eutectic steadite. A conclusion that may be drawn from this investigation is that low phosphorus steadite contracts or shrinks less than eutectic steadite.

[10] *Wust-Giesserei Zeitung*—pages 203-206, 1923. He gives the shrinkage of pure iron as 2.39, and iron with 1.7 per cent phosphorus as 1.3. Keep, *Cast Iron*, 1902, gives the shrinkage of a test bar from wrought iron as 0.292 in and the 10.2 per cent iron—iron phosphide as 0.164 in. If these investigators' methods are comparable, eutectic steadite has only about 3 per cent greater shrinkage than the solid solution form.

The most powerful factors for diminishing shrinkage are those which increase the amount of graphite. Phosphorus has little effect either in increasing or in diminishing graphite. Therefore, its influence on shrinkage is not profound. Some contend that greater fluidity due to phosphorus makes for better feeding and hence tends to minimize shrinkage cavities.

Receive Promotions

J. McA. Duncan, for 14 years Pittsburgh district manager, Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., has been appointed assistant general sales manager of the firm. W. R. Marshall, formerly branch manager, will assume the duties of Pittsburgh manager. H. F. Boe, formerly industrial division manager, Buffalo, has been promoted to branch manager of that office, and R. L. Kimber to industrial division manager. W. F. Barnes has been appointed branch manager of the Tulsa, Okla., office of the Westinghouse company.

Appointed Sales Manager

H. Kempner, formerly in charge of sales promotion work, has been appointed sales manager in charge of the hoist division, American Engineering Co., Philadelphia. Mr. Kempner studied electrical engineering at Harvard university, Cambridge, Mass., and later was an instructor at Pratt institute, New York. He formerly was connected with the Western Electric Co., Chicago, and the McGraw-Hill Publishing Co., New York.

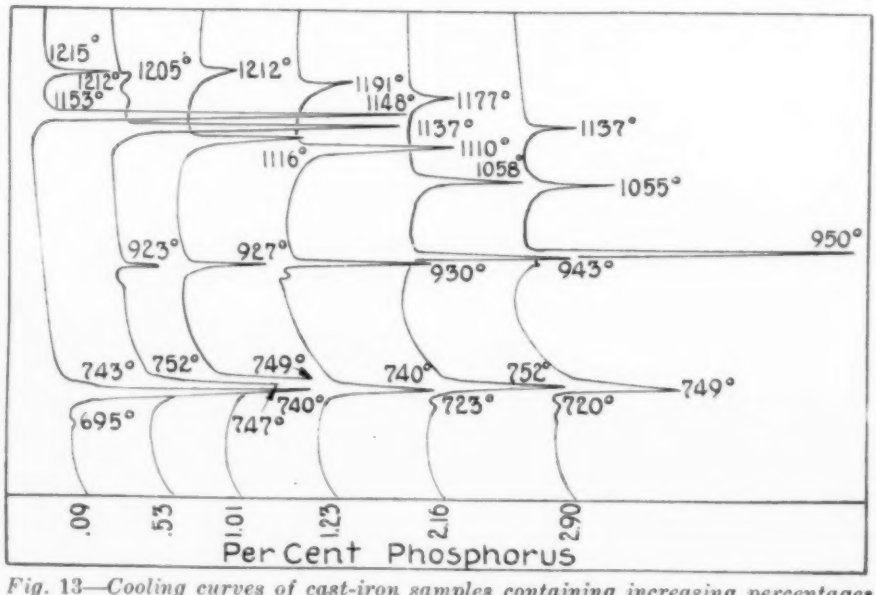

Fig. 13—Cooling curves of cast-iron samples containing increasing percentages of phosphorus. (H. I. Coe) (Reproduced from Sauveur) Temperatures are degrees Cent.

Making Cadillac Car Castings

Cylinder Blocks Made on a Sand Throwing Machine Are Molded and Poured in Three Part Flasks with the Barrels in a Vertical Instead of the Horizontal Position

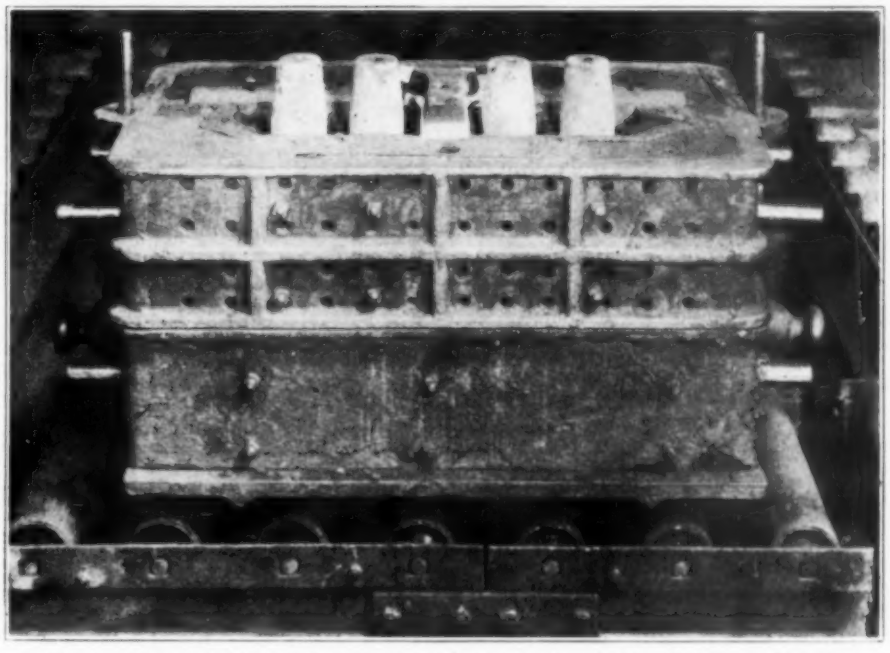

Fig. 2—Cylinder Molds in a Three-part Flask Are Cored and Assembled on a Conveyor

WITH the exception that the melting department is located outside the main building instead of in the center, the iron foundry of the Cadillac Motor Car Co., Detroit is arranged after the same plan as the aluminum foundry described in the Sept. 1 issue of THE FOUNDRY. The sand is prepared at the west end of the building, the molds are made, poured and shaken out in the first large main division in the center, a space 20 feet wide extending across the building is provided for knocking the cores out of the castings and finally, the castings are cleaned and chipped in a section of the building 80 x 142 feet at the extreme east end of the building adjoining the loading dock which extends all the way across the front of the three foundries.

The outside dimensions of the iron foundry building are 142 x 321 feet with an addition on one side 56 x 60 feet for a cupola department. The floor area of the iron foundry exclusive of the melting department, 45,582 feet differs but little from that of the aluminum foundry, also exclusive of the melting department, 44,962 feet.

Cylinder castings are molded, cored, poured and shaken out in a space definitely set apart close to the east end of the foundry. The remainder of the floor space is divided longitudinally into three main molding areas. Two gangways define the floor limits and also serve in their usual capacity to facilitate the movement of materials from one part of the foundry to another. Metal is distributed by ladles suspended from a monorail that parallels the route of the gangways.

On the north and south side, the molding floors extend from the wall to the gangway. In the center the floors extend from a center line to the gangways. In other words a double row of molding machines arranged back to back extends down the center of the shop. The molds from one row extend from the machines to the south gangway, the molds from the second row extend from the other line of machines to the north gangway. Molding machines to serve the remaining floors are arranged near the north and south walls of the building.

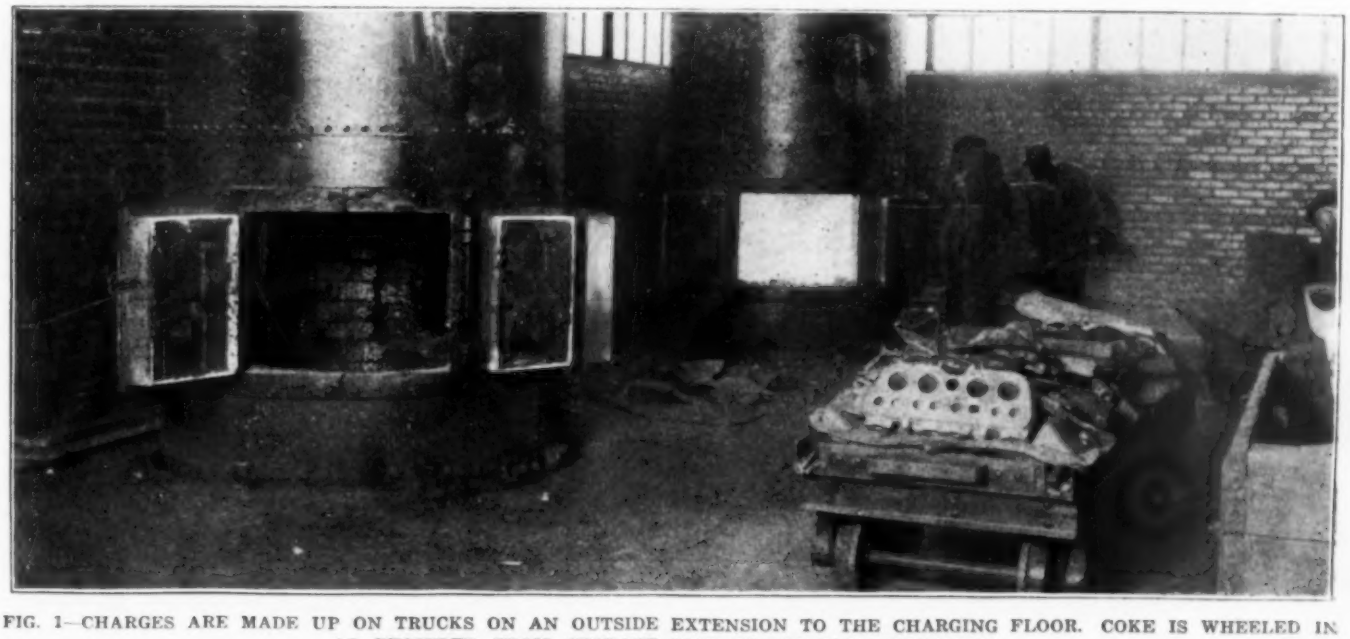

FIG. 1—CHARGES ARE MADE UP ON TRUCKS ON AN OUTSIDE EXTENSION TO THE CHARGING FLOOR. COKE IS WHEELED IN AS REQUIRED FROM STORAGE BINS ON THE SAME EXTENSION

The floor layout described was prompted by many reasons. It conserves floor space by the elimination of a longitudinal center gangway and also reduces the number of main distributing sand arteries required. If the conventional method of laying out the floor had been observed, four monorail branches would have been required to distribute the sand to the four lines of sand hoppers. With the present arrangement only three lines are needed. The twin hoppers serving the double row of molding machines in the center terminate in single openings at the top where they are served by the traveling buckets suspended from the monorail system. This hopper arrangement is illustrated in Fig. 3.

This illustration also shows that the system of arranging the molds for pouring is the same in the iron foundry as it is in both the aluminum and brass foundrys. Roller conveyors erected about 12 inches above the floor extend from a point close to each molding station to the edge of the nearest gangway. Each succeeding mold placed on the conveyor pushes those in front one space nearer the outer end. Pouring goes on continuously all day and in that manner a number of molds close to the end always are poured in time and dumped before the conveyor is filled from end to end.

Advantages of this arrangement are obvious. Instead of filling a long floor by carrying the molds from the machine, the molder in this instance simply lifts the mold from the machine, and places it on the conveyor within easy reach. Men at the other end of the conveyor attend to the pouring and shaking out, thus securing the fullest results from team work without hurry or congestion. Molding machines employed on a wide variety of miscellaneous castings were supplied by the International Molding Machine Co., Chicago; Arcade Manufacturing Co., Freeport, Ill. and the Osborn Manufacturing Co., Cleveland. A sand cutter made by the American Foundry Equipment Co., New York supplements the overhead sand handling and distributing equipment.

Cylinder Department

Several views of the cylinder molding department are shown in the accompanying illustrations. This department occupies a space approximately 50 feet in width and extending nearly all the way across the east end of the building. It is divided nominally into two sections by one of the rows of steel columns supporting the roof and the crane runways. The molds are made and assembled in the first section and then transferred on a roller conveyor to the second section where they are poured and shaken out.

Contrary to the practice in many American automobile foundries, the cylinder castings are molded and poured with the barrels in a vertical instead of a horizontal position. This necessitates the use of a three-part flask. Detail of the flask construction may be noted in Fig. 2. Each part is cast solidly in one piece. To insure rigidity the cope and also the drag is provided with an external flange on the joint side. An internal flange or sand strip also is provided on the inside to supplement the bars in holding the sand in place. Detachable bars are bolted from side to side.

The cheek or center piece of the flask is ribbed strongly on the outside both longitudinally and vertically to compensate for the absence of bars. Three short bars are bolted to the inside, but they only extend to within a short distance of the pattern and offer no resistance to the lateral strain exerted on the sides while the mold is filling with iron. Their only purpose is to prevent the sand in the cheek from sagging or falling out after this part of the mold has been re-

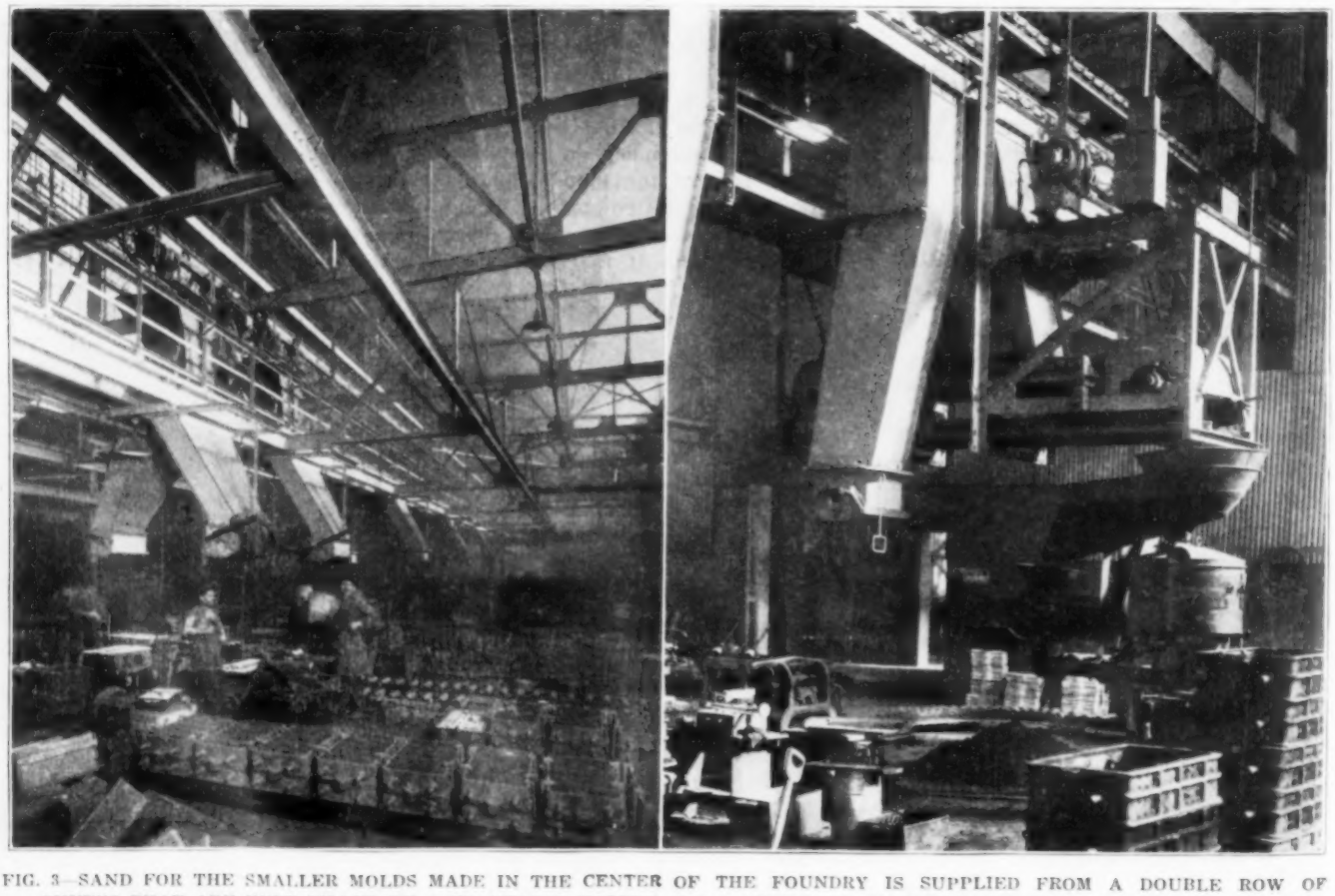

FIG. 3—SAND FOR THE SMALLER MOLDS MADE IN THE CENTER OF THE FOUNDRY IS SUPPLIED FROM A DOUBLE ROW OF CHUTES THAT ARE KEPT FILLED BY A TRAVELING HOPPER. FIG. 4—THE SAND THROWING MACHINE IS SUPPLIED WITH SAND FROM AN INDEPENDENT OVERHEAD SYSTEM

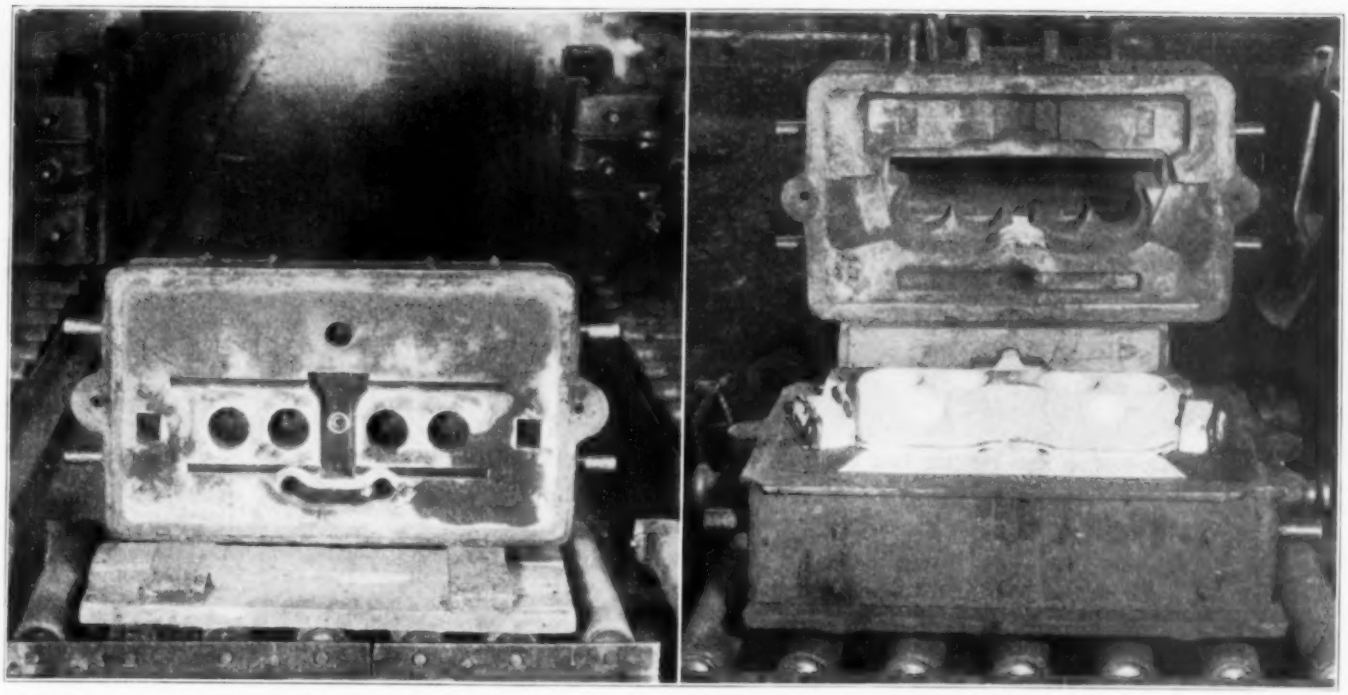

FIG. 5—AFTER THE CORES ARE PLACED THE DRAG IS SHOVED IN FRONT OF ONE OF THE CHEEK MOLDING MACHINES. FIG. 6—THE COPE FACE OF THE CYLINDER MOLD IS FLAT AND PLAIN WITH THE EXCEPTION OF A FEW CORE PRINTS

moved from the molding machine and pouring station. Numerous perforations in the sides of the cheek flask afford a ready means of escape for the gas and steam generated in the sand walls when the mold is filled with molten iron. The flasks are planed on the joints and the various parts are interchangeable. With the extremely thin walls of the cylinder castings and the limited machining tolerance allowed it is apparent that the pin holes on the flasks must be located with the greatest accuracy. The pins are removed from each flask after the mold is closed and used on the next flask following in the line. Hardened steel bushings in the pin holes insure a maximum term of service.

Use Three Part Flasks

A stationary type sand throwing machine made by the Beardsley & Piper Co., Chicago, and three jolt, stripping plate machines made by the International Molding Machine Co., Chicago, are employed in making the cylinder molds in green sand. With two patterns used alternately the cope and drag are rammed with the sand throwing machine and then placed on the conveyor which extends around the four sides of the space set apart for making the molds. On account of the intricate shape of the pattern a considerable amount of hand ramming is required to supplement the jolting which the cheeks receive.

Cheek flasks are filled with sand from suspended hoppers that receive their supply of sand from the main distributing system. The sand thrower is equipped with a short belt conveyor which takes the sand from under a storage hopper and feeds it into the chute on the machine leading to the revolving head. The cylinder making equipment has been designed for the production of 600 castings per day, the maximum requirement when the entire plant is operating at capacity with an output of 300 cars per day.

Molds are cored and closed while in transit on the conveyor traveling toward the south. This conveyor passes across the ends of six branch conveyors located at right angles and extending toward the east end of the building. Turntables in the first conveyor at three points furnish a ready means for transferring the molds from one conveyor to another. The six conveyors are arranged in four groups, two single lines on the outside of the space and two double groups in the center.

Pouring the Iron

From the arrangement which is shown in the illustration Fig. 7 it may be noted that only a minimum of space is taken up by the three gangways that separate the various groups and offer clear spaces for the travel of the pouring ladle back and forth. The ladle is supported on a special device made by the Shepard Electric Crane & Hoist Co., Montour Falls, N. Y. and is provided with a double lip so that the operator may pour a row of molds either on the right or the left.

The entire pouring floor is spanned by a crane which travels back and forth in line with the rows of molds. A transverse movement of the device supporting the ladle is secured from a trolley mounted on the bridge of the crane. The cage containing the ladle and in which the operator travels is suspended from a section of steel beam similar to the remainder of the monorail extending from the cupolas to various parts of the foundry. Through a suitable switch equipment the ladle carrying device is transferred to and from the crane whenever necessary.

Cleaning the Castings

Among the many advantages claimed for this method of handling the metal are economy and speed. One man with the equipment shown pours approximately 30 tons of iron per day. Through constant practice he becomes adept and pours the rows of molds speedily, cleanly and accurately. The ladle is designed to hold enough iron to pour 10 molds and this item in itself presents many advantages. By catching the metal from the spout first in a mixing ladle and then transferring it to the regular pouring ladle a homogenous mixture is obtained. The large volume in the ladle retains its heat and the physical characteristics of the iron in the various castings apparently is of a more uniform character than where the castings are poured from individual ladles. With a ladle of known capacity in relation to the number of molds the amount that is left in the ladle each trip and which has to be pigged is reduced to a minimum.

Castings are shaken out under a

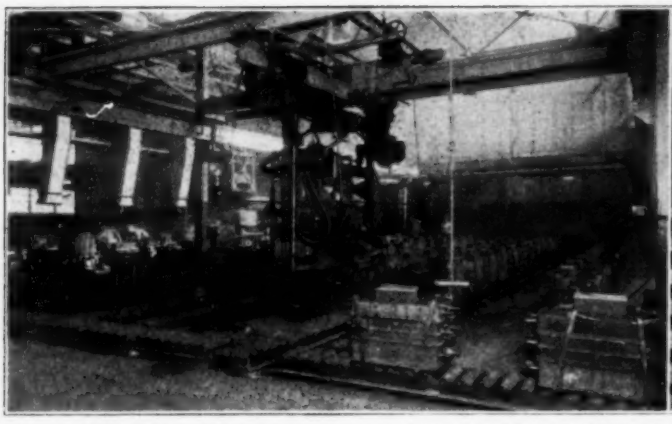

FIG. 7—CYLINDER MOLDS ARE SET UP FOR POURING IN TWO SINGLE AND TWO DOUBLE ROWS. FIG. 8—ONE CORNER OF THE CYLINDER MOLDING FLOOR

monorail at the extreme eastern end of the conveyors. The sand falls through gratings in the floor and is conveyed back to the sand mixing station from which it emerges again a short time later as part of the never ending stream flowing to the various molding stations during the day. The castings are taken through a doorway into a long room lying between the foundry and the cleaning room. The flasks are replaced on the conveyor and returned to the molding station.

All the unburned sand together with the wires and arbors are salvaged in the room where the castings receive their preliminary cleaning. The burned sand both from the molds and cores is dumped through an opening in the floor on to a moving belt which conveys it to the boot of a bucket elevator located in the yard close to a railroad track. The elevator lifts the waste sand and discharges it through a spout into a waiting gondola spotted there for the purpose.

Cylinder castings are suspended by hooks from a monorail which passes through a sandblast chamber made by the W. W. Sly Manufacturing Co., Cleveland. Later, they are ground, chipped and tested under water pressure and finally loaded on the dock in front of the building for shipment to the machine shop.

For cleaning the other castings, the cleaning room is equipped with two rotary table sandblasting devices made respectively by the American Foundry Equipment Co., New York and the Pangborn Corp., Hagerstown, Md. In addition to the sandblast equipment the cleaning room is provided with 12 tumbling barrels made by the Whiting Corp., Harvey, Ill. at one end of the building and 6 tumbling barrels made by the W. W. Sly Manufacturing Co., Cleveland, at the other end. Grinding wheels are set up near the front wall and chipping benches are provided at various points on the floor near the center.

Iron is melted in three 42-inch cupolas made by the Whiting Corp., Harvey, Ill. One is used in the morning, one in the afternoon and the third is held as a spare. In this manner melting is carried on continuously and at a speed that equals the production of the molds on the various floors. The melting period for each cupola is not excessive and as a result the lining easily is kept in good condition.

The charging floor shown in Fig. 10 is an extension of the charging deck immediately surrounding the cupolas and shown in Fig. 1. It extends out into the yard 50 feet, is roofed over, enclosed on three sides and open on the fourth for the passage of a 5-ton crane made by the Shaw Crane Co., Muskegon, Mich. The crane is equipped with a magnet and lifts all the iron required from the various stock piles in the yard to the bins on the charging floor. All pig iron and scrap are classified according to arbitrary standards that facilitate the work of the ordinary laborers who actually make up the charges on the buggies.

A man without training or any great intelligence can carry out instructions to load four buggies in succession from bins 1, 2, 3 and 4. The same man practically would be a total loss if told, for example, to select from the scrap pile one load of

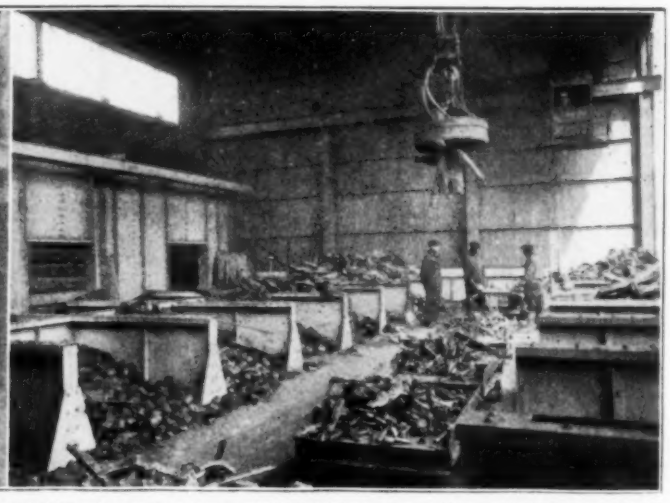

FIG. 9—IRON FROM THE CUPOLA FIRST IS CAUGHT IN A MIXING LADLE AND THEN TRANSFERRED TO THE POURING LADLE SUSPENDED FROM A MONORAIL HOIST. FIG. 10—IRON FOR CUPOLA CHARGES IS LIFTED FROM THE STOCKYARD BY A 5-TON CRANE AND DEPOSITED IN THE VARIOUS BINS ACCORDING TO A DEFINITE CLASSIFICATION. COKE IS STORED IN AN ADJOINING SHED

soft scrap, one load of hard scrap and two others of varying intermediate grades.

On each cupola the bed charge of coke amounts to 1300 pounds. The iron charges are held uniformily to 800 pounds with 130 pounds of coke between. A small quantity of shot nickel is added to each charge of iron in the cupola. It is claimed that the nickel improves the quality of the iron in several particulars including an increase in the strength and hardness without a corresponding increase in the time required for machining. The subject of mixtures for automotive castings was covered extensively by H. B. Swan, foundry superintendent Cadillac Motor Car Co., in a paper presented before a convention of the American Foundrymens association in Cleveland, April 28-May 3, 1923. This paper was published in THE FOUNDRY, May 15, 1923.

Organize for Pipe Standardization

THE organization meeting of the sectional committee on specifications for cast iron pipe and special castings, which has been formed under the auspices of the American Engineering Standards committee to standardize cast iron pipe and special castings for all uses, was held at the Engineering Societies building, New York, April 21 and 22.

The meeting was begun under the guidance of the four sponsor societies, namely, American Water Works association, New England Water Works association, American Gas association and American Society for Testing Materials, through the agency of the so-called steering committee, made up of F. A. Barbour (A. W. W. A.); F. A. McInnes (N. E. W. W. A.); W. C. Morris (A. G. A.); and C. L. Warwick (A. S. T. M.) Chairman.

The sectional committee elected officers and an executive committee, adopted a set of rules for its own government, agreed upon a sub-division of the work of the committee between three so-called technical committees and appointed tentatively the members of these committees. The following officers and executive committee were elected: chairman: Thos H. Wiggin, consulting engineer, New York; vice chairman N. F. S. Russell, president, United States Cast Iron Pipe Co., Burlington, N. J.; secretary, C. C. Simpson, Jr., general superintendent of mains and services, Consolidated Gas Co. of New York.

Executive Committee

The executive committee consists of the three officers, ex officio, and the following eight members: W. D. Moore, president, American Cast Iron Pipe Co.; A. M. Campbell, Glamorgan Pipe & Foundry Co., Lynchburg, Va.; C. R. Wood, Manufacturers' Standardization Society of the Valve Fittings Industry, Philadelphia; W. C. Morris, chief engineer, Consolidated Gas Co., New York; W. W. Brush, deputy chief engineer, department water supply, gas and electricity, New York; C. W. Sherman, consulting engineer, Boston; F. A. Barbour, consulting engineer, Boston; and C. L. Warwick, secretary, American Society for Testing Materials.

Committee on Dimensions

Assignments to the three technical committees were as follows: W. C. Hawley, chairman pro tem, chief engineer and general superintendent, Penn. Water Co., Wilkinsburg, Pa.; W. R. Conard, Conard & Busby, Burlington, N. J.; I. J. Fairchild, bureau of standards, Washington; A. M. Ford, assistant engineer, National Cast Iron Pipe Co., Birmingham, Ala.; C. W. Mowry, director, Factory Mutual Laboratories, Boston; D. B. Stokes, general sales manager, United States Cast Iron Pipe & Foundry Co., W. G. Hammerstrom, Lynchburg Foundry Co., Lynchburg, Va.; F. H. Stephenson, assistant superintendent, department of water supplies, Detroit; Shellman B. Brown, superintendent, Warren Foundry & Pipe Co., Phillipsburg, N. J.; Kent S. Clow, vice president, J. B. Clow & Sons, Chicago; H. E. Bates, assistant chief engineer, Peoples Gas Light & Coke Co., Chicago; J. E. Gibson, manager and engineer, commissioner public works, Charleston, S. C.; A. W. Claussen, assistant engineer, Underwriters Laboratories, Chicago; L. P. Wood, assistant engineer, board of water supply, New York, C. R. Knowles, superintendent, water service, Illinois Central railroad, Chicago.

Corrosion and Protective Coatings

L. P. Wood, chairman, pro tem, assistant engineer, board of water supply, New York; S. R. Church, technical advisor, The Barrett Co., New York; J. E. Gibson, commissioner public works, Charleston, S. C.; W. G. Hammerstrom; F. A. McInnes, consulting engineer, Boston; E. E. Wall, water commissioner, St. Louis; Shellman B. Brown; W. S. Finlay, American Water Works & Electric Co.

Metallurgy, Process and Tests

H. E. Bates, chairman pro tem; I. J. Fairchild; Dr. Richard Moldenke, consulting metallurgist, Watchung, N. J.; F. H. Stephenson; Prof. A. N. Talbot, University of Illinois, Urbana, Ill.; W. C. Hawley; W. G. Hammerstrom; A. M. Ford; D. P. Hopkins, vice president, United States Cast Iron Pipe & Foundry Co.; Shellman B. Brown, George Castor, vice president, Donaldson Iron Co., Emaus, Pa.; Walton Forstall, engineer of district, United Gas Improvement Co., Philadelphia.

The assignments to technical committees are in part tentative, and, in accordance with the well established custom for committees organized under the auspices of the American Engineering Standards committee. It is intended to make additions as may be found desirable to the membership of these technical committees and their subcommittees.

The scope of the entire work and that of each technical committee was discussed at the meeting on the second day and technical committees on metallurgy, processes and tests and on corrosion and protective coatings held meetings and began their work.

The committee will be able to build on work already accomplished by pipe committees of the American and New England Water Works associations and the American Gas associations and to ally itself with the sectional committee on pipe flanges and fittings in relation to the subjects within the scope of that committee. Much valuable investigating work on quality and tests for cast iron in pipes already has been done in the past two or three years by one or another group of pipe foundries. Some of this work has been published in the *Proceedings* of the American Society for Testing Materials and more will follow this spring before that society and before the American Water Works association. The bureau of standards also is at work on certain other pipe problems so that the new sectional committee will have much new data to study at the outset.

The producers have promised financial support for extending such of these and kindred investigations as shall appear, on due consideration by the committee, to be promising of constructive results.

FURNACES FORM TOPIC

Round Table Session at Spring Meeting of the American Electrochemical Society Develops Discussion of Various Types of Melting and Heat Treating Furnaces—New Officers Are Announced

ADVANCE announcement of a round table discussion, devoted to the subject of the comparative merits of electric and fuel fired furnaces attracted about 125 interested individuals and company representatives to a luncheon held during the spring meeting of the American Electrochemical society in Chicago, April 22. William J. Priestley, Electro Metallurgical Sales Corp., New York, who presided at this session, introduced various representatives of electric melting furnaces who spoke on the performance of this type of equipment in making steel and gray iron.

One maker of large electric furnaces described the introduction of dual or three step voltage regulation, which provides a high input during melting down and a reduced voltage in the later stages during the refining operation. This operation is said to reduce refractory losses, since the maintenance of the longer arc after the bath is formed increases the radiation effect upon the walls and roof of the furnace. With three step voltage reduction, a 6-ton furnace was reported as having completed a heat of 17,000 pounds in 1½ hours, against 2½ hours when the lower rate of input was maintained throughout operation.

The tremendous growth of electric furnace melting was reflected in the remarks of a maker of small, foundry type furnaces, who reported the first unit installed in this country about 1909, with 19 in service four years later, 40 active in two years and more than 450 now melting steel or gray iron throughout the country. It was emphasized that the electric furnace is not a competitor of the cupola for foundry melting of gray iron, but, where quality governs, the electric unit is recommended. In making comparisons, the basis of cost in terms of final product was emphasized.

As between the electric furnace and the open-hearth furnace, one alloy producer emphasized the question of quantity of finished steel and opposed all effort to strike a universal balance. He pointed to the fields in which each type is bound to maintain its supremacy. The question of the probable effect of the arc upon the quality of metal produced particularly where the current is supplied at voltages as high as 220 or more was raised. An electric furnace representative reported two 12-ton furnaces operating on steel ingots for war service, where the rejections on metal reduced at high voltage were 5 per cent against four times that amount on ingots poured from metal melted at a lower rate. He did not infer from this that the high voltage practice was responsible for superior quality, but rather that the arc effect is neglible.

Furnace Is Flexible

The electric furnace was commended on the score of flexibility, and its ability to deoxidize or de-gassify steel. The probable effect of nitrogen absorption in electric furnace steel was discounted by a government experimenter who studied the question.

A furnace operator from the west coast reported the ability to make gray iron synthetically in the electric furnace cheaper than it could be produced from eastern pig iron melted in the cupola. Further, the ability to change the character of the charge, making first iron, then semisteel, manganese and chromium steel successively from the same scrap pile was affirmed. The state of the graphitic carbon in electric melted gray iron was described by one speaker as being emulsified to a greater degree than in the cupola metal. For this reason, it was stated that the electric iron machined more readily, was tougher and more resilient than the cupola product. In discussing the various types of melting units for nonferrous metals, a foundryman presented figures showing operating economies in electric melting with savings in labor and heating cost developed by the induction type of unit. The refractory problem in induction furnaces still is present, according to this speaker, but conditions are much improved over a few years past. Crucible type, high frequency furnaces were said to melt phenominal poundage without apparent effect upon the crucibles used. This foundry reports 3 gallons of oil required per 100 pounds of metal in open flame furnaces, with 290 to 300 cubic feet of gas per 100 pounds of metal melted in gas fired units. Against this is a current consumption of 270 to 280 kilowatt hours in the induction type and 300 to 320 kilowatt hours in the direct arc type electric furnace, per 100 pounds melted. These figures are compiled by the company.

The question of proper pouring temperature for nonferrous metals was stated to be paramount. A brass castings manufacturer melting 50,000 pounds per day stated that the temperature of every ladle or crucible of metal is checked. Special thermocouples are used, with permanently mounted pyrometers to which each ladle is brought. These instruments are checked every morning, since a variation of 100 degrees in pouring temperature has been found to make upwards of 10,000 pounds difference in the tensile strength developed in certain alloys.

In melting aluminum, a manufacturer of electrical equipment reported a cost of $1.75 per 100 pounds cost on coke fired furnaces, against $0.85 per 100 pounds on resistor type electric units using cast iron pots.

Discussion of various types of heat treating furnaces elicited some heated controversy. The experience of various automobile builders with electric units was quoted as showing a re-

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Columbia university, New York

duction to a minimum in rejections for defects in heat treating.

Representatives of gas companies challenged the superiority claimed for electric heat treating furnaces, although stating that in engineering development, the former in many cases have shown the greater initiative. It was stated that the installations of electric heat treating equipment at present are in excess of 1,500,000 kilowatt capacity or about a tenth of the total electric motor capacity in the country.

The technical sessions of the society held Thursday, Friday and Saturday, April 22 to 24, were devoted to various phases of the chemistry of chlorine, problems of electrodeposition and the protection of ferrous metals from corrosion. At the business session, held Saturday morning the officers elected by letter ballot were announced. These are as noted in the accompanying box. A resolution was adopted unanimously, calling upon congress to advance the annual salaries of federal judges, as it was announced that those who attained proficiency were so poorly paid that the attractions of other fields led them to resign from the judiciary, with a deleterious effect upon patent decisions in which members of the society are interested. Dr. Edward Weston, Weston Electrical Instrument Co., Newark, N. J. was elected to honorary membership in consideration of his services to the society and to industry. Harry M. Williams, General Motors Research Corp., Dayton, O. was chosen chairman of the electrothermic division of the society and H. W. Gillett, bureau of standards, Washington, was elected vice chairman.

Casting Steel in a Brass Foundry

By Martin Burns

Superinten'ent, R. B. Carran & Sons, Ludlow, Ky.

PROBABLY the first successful crucible steel casting made in Cincinnati or vicinity, was poured in the foundry of the Lunkenheimer Co. on Nov. 11, 1908. It is specially noteworthy since the entire process was worked out in a brass foundry, and the success attained is a strong lesson on what may be done in any foundry which is fully equipped and where modern methods and apparatus are used intelligently.

The operation melting, molding, and pouring were supervised by J. L. Hopper, the Cincinnati Steel Casting Co., the writer then foreman, the Lunkenheimer foundry and Mr. Elliott, chief chemist of the latter concern.

The casting was a gear wheel, 10¾ inches in diameter, 1¼ inches at base of tooth, and 2½ inches x 2 inches at the hub. In making the mold a considerable fillet was made at the base of the hub to avoid shrinkage cracks at that point. Six vents were placed in the cope of the mold, which evidently were efficacious in leading off the gases as no blow-holes were formed.

The chief stock used for the steel was boiler punchings of the following analysis: Carbon 0.15 per cent, silicon 0.004 per cent, manganese 0.46 per cent, phosphorus 0.059, per cent, sulphur 0.027 per cent. Before removing the metal from the furnace small quantities of ferroalloys were added to give the desired quality of steel.

The stock was melted in a regular steel crucible in an open flame furnace, which, however, was somewhat modified according to the ideas of the writer. Constant attention was paid to the furnace temperature which was measured with an optical pyrometer. By keeping a check on the furnace in this manner, the temperature was not allowed to lag and in less than three hours' time the metal was hot enough. However, to make sure of this, a half pound can of thermit was added to the metal and a small increase of temperature was noticed. The crucible was withdrawn at a temperature of 3149 degrees Fahr. and the mold filled. The pot then was carried about a hundred feet and the remainder of the metal poured into small ingot molds. The metal still was hot enough to run clean from the crucible leaving no trace of a *skull* or other chilled residue.

The analysis of the casting was as follows: Carbon 0.21 per cent, silicon 0.34 per cent, manganese 0.28 per cent, phosphorus 0.059 per cent, sulphur 0.044 per cent.

Conforms to Specifications

Compared with the original charge there is an increase of everything except phosphorus and manganese. The increase of carbon, and silicon was due to the addition of alloys which were made intentionally. The sulphur increased slightly due to sulphur in the fuel oil which ran 0.32 per cent, and a small amount of which probably combined with the metal. This steel conforms to the most rigid specifications, including those of the American Society for Testing Materials, which call for not over 0.060 per cent of either phosphorus or sulphur.

The metal machined readily. The scleroscope hardness was 27 on the universal scale or 47 with the magnifier hammer. This is about the hardness of ordinary soft machinery steel or a little softer than bell-bronze. A small fin was left purposely on the outer edge of the tooth, to demonstrate the malleability and at the same time the strength of the metal.

Foundry Instructors To Hold Annual Meeting

Following the successful meeting of foundry instructors held in conjunction with the 1925 Syracuse meeting of the American Foundrymen's association, plans have been made to make this meeting an annual affair. The second meeting will be held at Detroit at the time of the second international foundrymen's congress and 30th annual convention of the American Foundrymen's association. Foundry instructors in the various technical colleges and schools throughout the country have been invited to participate. Short papers describing the foundry courses at Purdue university, Carnegie Institute of Technology, and the universities of Michigan and Illinois will be read. After the papers are read the meeting will be thrown open for a general discussion of foundry instruction. In addition, the committee in charge of this group meeting is planning an inspection trip to the University of Michigan.

All foundry instructors attending the meeting will be invited to participate in the technical sessions of the foundrymen's congress and to inspect the exhibit of foundry equipment and supplies.

Receives Appointment

Edward H. Ruck, formerly with the White Motor Co., Cleveland, has been appointed mechanical engineer by the W. W. Sly Co., Cleveland, manufacturers of sand blast machines and other foundry equipment.

Make Bronze Castings for Water Meters

By Herbert R. Simonds

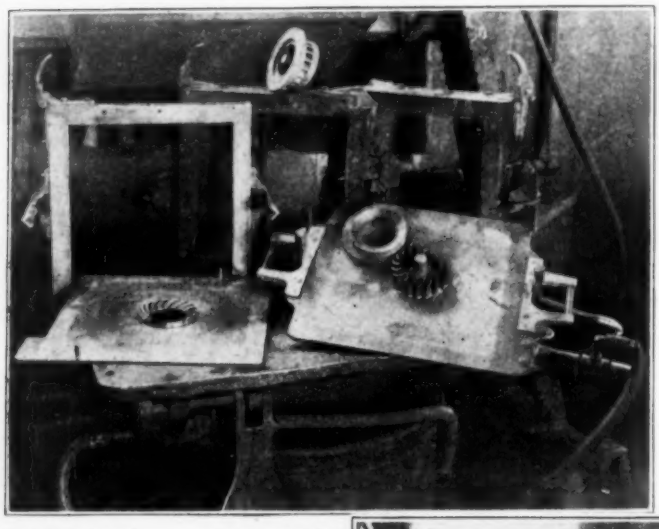


Fig. 1—(Left) A Difficult Casting Having 18 Curved Blades Is Made Without Cores by Using a Matchplate

HAVE you ever noticed that when the water is turned on at any faucet in the house, a rapid click, click, click may be heard in one corner of the basement? This is the water meter which is keeping an accurate record of the number of gallons of water consumed. Some years ago city departments charged a flat monthly or yearly rate for water, which frequently was based on the number of faucets or outlets. As the per capita demand for water increased, the flat rate proved an undesirable means of obtaining sufficient revenue. Increasing the flat rate meant penalizing the small user to pay for the excess water consumed by the large user. To overcome this injustice, city departments rapidly have been changing to metered service during the past ten or 15 years, which has built a tremendous demand for water meters.

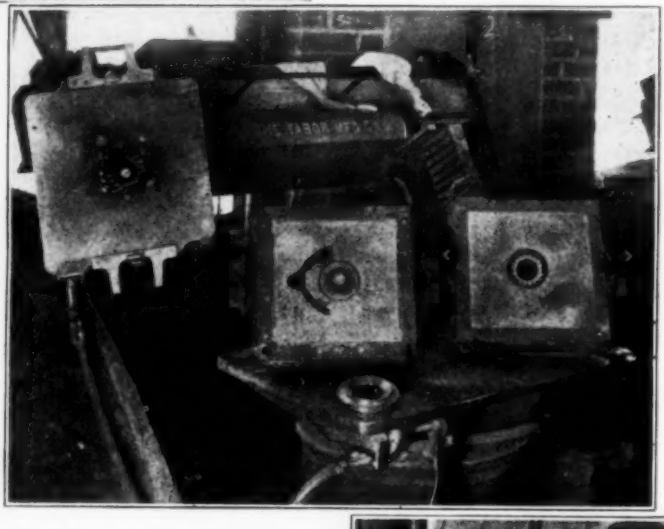


Fig. 2—(Above) The Completed Cope in the Center and the Check at the Right. Fig. 3—(Left) The Mold Being Assembled

Approximately ten manufacturers supply practically all of the meters used in this country. The Hersey Mfg. Co., South Boston, Mass., is one of the oldest as well as one of the largest companies engaged in the manufacture of this line. This company, which was organized in 1859, has moved into new and larger quarters several times during its history, and now occupies a modern five story brick plant. The bronze foundry is located on the fifth floor of the building overlooking Boston harbor, and enjoys a location seldom equalled in the foundry industry. Ample light and fresh ocean breezes combine to make ideal working conditions for the workman.

The foundry is modern in its equipment and layout. The castings, which enter into the construction of water meters, are not simple, and it has taken considerable ingenuity to adapt matchplates to the molding machines. The product of the plant is confined to standard styles and sizes of meters, so that the work going through the foundry is practically all production work. Not many foundrymen manufacture a product as stable as that made by the builders of water meters. Since the production of a single piece extending over a period of years is great, the cost of the matchplate becomes a negligible item. A large airy, well-equipped room is devoted to the production of matchplate equipment. Some idea of the work of this department may be understood by noting the equipment shown in Fig. 1. The matchplate department, which is run as a separate unit, takes care of the maintenance of plates as well as their original construction. Since experience has shown that most of the wear and tear on a plate ordinarily develops in general handling away from the individual molding floor, this department has constructed steel racks for the plates, as shown in Fig. 5. These racks are placed at one end of the foundry floor and it is the duty of the molders to return all plates to their proper place in the rack as soon as the jobs are

completed. Suitable hooks are provided at the left of each molding machine to hold the plates at night when the molder is to continue on the same job in the morning. Molders are instructed to clean plates thoroughly each night, and these plates, as they hang alongside of the molding machine, are inspected frequently. This seemingly small detail has reduced plate costs greatly, and the steel filing racks are given credit for a big saving, both in the time of getting started on new work and in the reduced wear and tear on plates due to handling.

Molding Practice Simple

The molding practice is comparatively simple as should be the case in a production shop. However, the complicated nature of the castings manufactured at this plant has necessitated considerable study in developing labor-saving equipment. About 90 per cent of the work now is done with aluminum plates on squeeze and roll-over type molding machines. Certain complicated castings are being produced on plates where at first it seemed impossible to adapt this practice to the type of work. To make plate work possible it has been necessary to use three part molds in many cases.

One of the most difficult castings to mold on a plate is known as the torrent deflector casting. The operations in connection with this piece are shown in Figs. 1, 2 and 3. The casting itself is a cylindrical bronze runner with 18 small curved blades held by rings at each end. This means that there are 18 small pockets, which under normal practice for a relatively few castings, would necessitate 18 cores to each mold. The equipment consists of two plates and a brass ring pattern. The first operation is to ram up the cope using the reverse side of the plate shown in Fig. 1. The completed cope for a 2-inch deflector is shown in the center in Fig. 2. After the cope is rammed, the cope and the plate are rolled over. The thin cheek plate, shown at the left of Fig. 1, is slipped over the projections on the main plate, the cheek frame is set in place, and the cheek itself rammed up. The brass ring pattern is placed over the projecting blades of the plate and is held in place snugly by a slight depression or shoulder. The drag then is rammed up around this ring after which the whole mold is rolled over. The cope is withdrawn, the plate is drawn out of the cheek carefully, the stripping plate is removed, the cheek mold is removed, the ring pattern is lifted from the drag, and the drag then is taken from the machine and set on the floor. The cheek and cope then are set in place to complete the mold.

The auxiliary plate called a cheek or stripping plate is used to secure the peculiar curved surfaces desired between each blade at the top and bottom rings. It has been found that the simplest way to secure accurate curves for these surfaces is through the use of the auxiliary plate, which fits snugly over the blades to complete the form at their lower ends, and of the snug fitting brass ring, which fits over the outer ends of the blades. The auxiliary plate also proves valuable during stripping by holding the sand in place and insuring vertical drawing of the plate. One man operating a molding machine with this plate equipment produces 50 to 60 complete molds per day for a 2-inch deflector casting.

FIG. 4—A SPECIAL LAYOUT IS USED FOR SYMMETRICAL CASTINGS

Several simple symmetrical castings are molded with patterns similar to the one shown in Fig. 4. The casting shown in the illustration is known as a ⅝-inch bottom case. The pattern equipment used is made up of four parts, two corresponding to the drag half of the pattern and two to the cope half. Both the cope and drag are made from the same pattern, the cope being turned through 180 degrees before being placed on the drag. One molder makes 80 complete molds per day with equipment similar to that shown in Fig. 4. He first makes up the half of the mold to be used as the drag, places it on the floor and then makes the cope half. This method of molding is convenient only for castings which are symmetrical in form.

Having paid special attention to the molding equipment the next logical step in the development of the present foundry was the modernizing of the furnace equipment to insure uniform metal. Six 400-pound tilting gas fired furnaces are arranged in a row under an ample hood as shown in Fig. 6. One of the furnaces is used to preheat the ladles and the bronze is melted in the other five units. Great care is taken to produce a uniform high grade metal. All of the castings in the foundry are made from one or the other of two kinds of metal. The first known as grade 1 conforms to government bronze specifications and is made entirely of virgin metal. The second known as grade 2 contains sprue and defective castings in addition to the virgin metal, but no outside scrap.

The pouring operation is exceedingly simple. From eight to nine heats a day are taken from each furnace. When the metal in the furnace is ready for pouring, the plugs at top and bottom are removed and the furnace tilted to pour the metal into the ladle. After the metal has been poured, the furnace again is returned to its normal position, its cover is removed, and the new heat, which already has been made up and placed in tote boxes, is charged.

The entire operation of taking off a heat and recharging is done in less than ten minutes. The ladles are carried in the customary way by two men to the individual molding floors. These two men together with a third constitute a pouring gang. Under normal conditions the furnace opera-

tion is timed so that three gangs do all of the pouring.

The raw materials used in charging are received in a store room in the basement of the building. From this point they are taken up to the molding floor on an elevator as required, so that only a minimum amount of raw materials are kept at the melting department. Two melters have charge of the furnaces. These men also look after the gas supply, which is regulated carefully to a given uniform heat and thus to make it possible to gage the heats by time.

The foundry as has been mentioned is on the top floor of a five story building. The castings from the foundry floor are picked up in tote boxes, hauled to the grinding and cleaning room, and then passed down through successive departments until they reach the shipping room on the first floor. The plant, including the furnace floor is kept remarkably clean as the illustrations show.

Publish Bibliography

Generally, before beginning any problem the research worker consults all the available literature pertaining to the subject. In many cases it involves a great deal of effort to make certain that no stone has been left unturned—no page uncut. About two years ago the Engineering Societies' library was commissioned by the division of engineering and industrial research of the National Research council to review scientific, engineering, technical and trade publications for

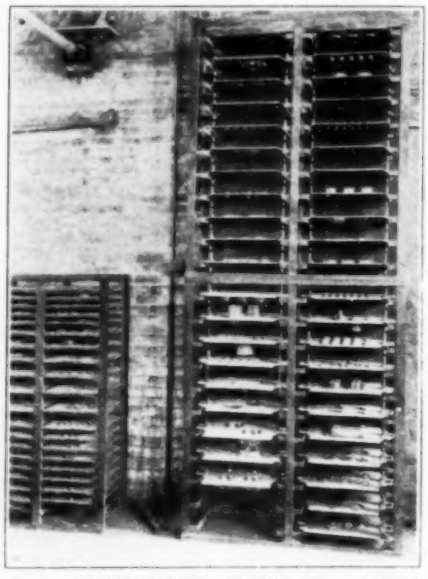


FIG. 5—PLATES ARE STORED IN A STEEL RACK AT ONE END OF THE FOUNDRY

articles on research. During these two years nearly 1500 references were accumulated and are now published in a bulletin by the National Research council. The bibliography covers every industry and will be found valuable to anyone contemplating research. Further information may be obtained by addressing National Research council, 29 West 39th street, New York. Maurice Holland is director of the division of engineering and industrial research.

Book Review

Chemical Engineering and Chemical Catalog, Second Edition, edited by D. M. Newitt, 360 pages, cloth 7 x 9½ inches, published by Leonard Hill, London, and supplied by THE FOUNDRY, Cleveland, for $5.00, net.

Consulting and contracting engineers, works managers and others engaged in the purchase of plant equipment, raw materials, etc., for the chemical industry will find this a handy reference book. The various materials, etc., are listed alphabetically with the source of supply. This index is followed by an alphabetical directory of manufacturers of chemical products and their wares. A third index or directory contains plant equipment and manufacturers. Various tables and data of interest to the industry are tabulated on 45 pages. The remainder of the book is devoted to an index of the industrial application of materials and plants. This will be of interest to manufacturers who wish to supply certain fields or to extend the use of their products to other fields.

Builds New Plant

Contracts have been awarded by the F. J. Ryan & Co., Philadelphia, for a new plant and office building at Hunting Park and Wissahickon avenue. All business and executive departments will be consolidated in the new building which also will contain a complete testing laboratory. The Ryan company manufactures burners and automatic combustion and temperature control devices.

Pig iron imports into the United States in 1925 were valued at $7,951,000. In 1924 the value was $3,741,000 and shows the increase for 1925 as 112.5 per cent.

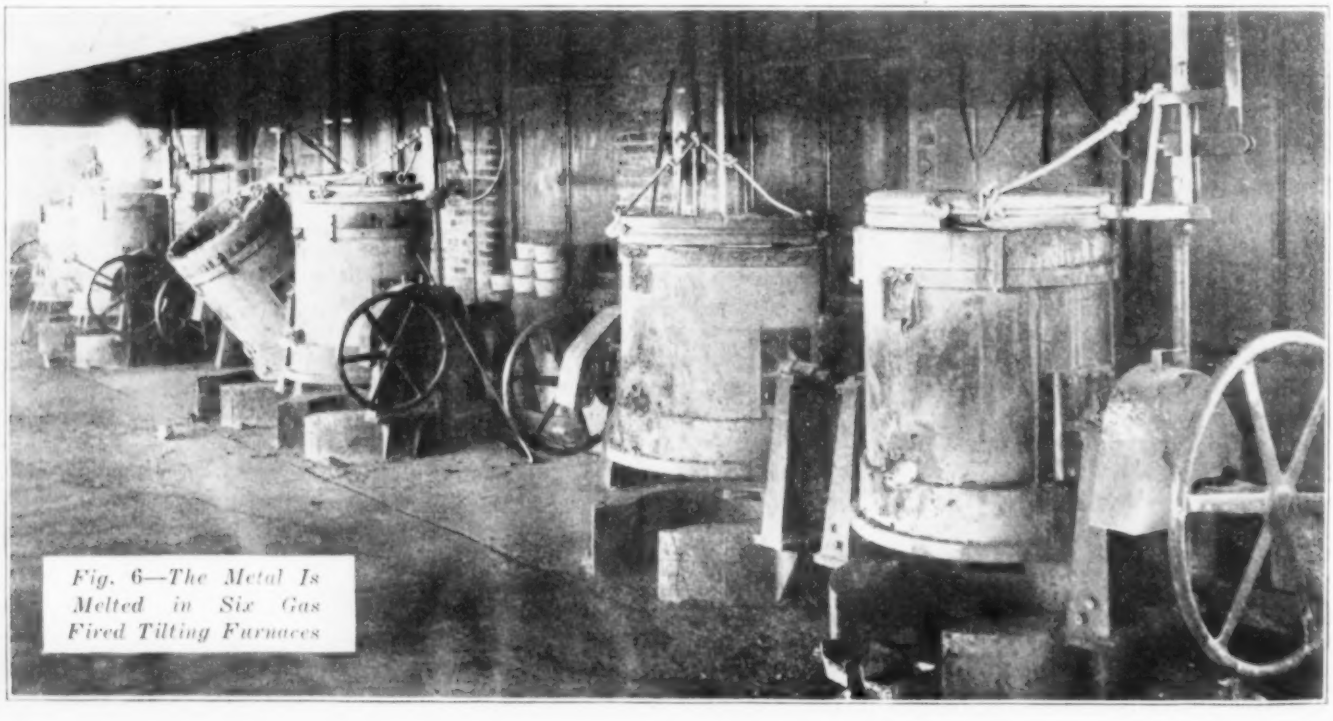


Fig. 6—The Metal Is Melted in Six Gas Fired Tilting Furnaces

How and Why in Brass Founding

By Charles Vickers

Remove Gates and Risers

We have experienced considerable difficulty in the removal of large risers from bronze gear castings. The method now used is to saw them off by hand and finish the cleaning with grinding. It has occurred to us that an acetylene torch might be used to advantage for this purpose, and we wonder if it would have any effect on the metal.

If the gears are blank gears, that is minus the teeth, and the risers are gated into the periphery, the most economical method of removing such risers is to break them off while the casting is hot. Then clean the casting with a spade if large, or with a heavy file or rasp if smaller. In order to break off such a riser, the gate must be filleted so it will not *break in* or tear out a part of the casting. Such gates should be rectangular in cross section with the long sides vertical, and the fillet is made by simply cutting away the sharp edge of gate where it adjoins the casting. Such gates should not be *thumbed* to prevent washing of loose sand, but slicked. The back of the heel of the slick makes a perfect finish of the corners at the joining of sides and bottom. A casting so finished needs only a little grinding and steel brushing to be ready for shipment. If the risers are placed on top of the gear ring and the point of juncture is large, it is dangerous to attempt to to break them off hot, and they must be sawed or turned off. An acetylene torch could be used, but is not a tool to be entrusted to any laborer, as it has to be employed skillfully. As far as its effects on the metal are concerned it will do no harm, for it is frequently employed to cut up defective bronze castings to reduce them to sizes convenient for remelting.

Standard Alloy Strength

We are using an alloy of copper 85 per cent; tin 5 per cent; zinc 5 per cent, and lead 5 per cent, which our customers claim is too hard, so we thought of changing it to copper 87 per cent; tin 1 per cent; zinc 6 per cent, and lead 6 per cent. Can you furnish us with the physical properties of these alloys, such as tensile strength; elongation and hardness.

The alloy to be substituted for 85, three fives, is of course much softer but as it is not a standard alloy we are unable to give its physical properties. These, however, would be medium.

The physical properties of 85, three fives, will vary greatly with the manner in which the test bars are cast, and with the shape of the bars.

The tensile strength of 85-5-5-5, runs from 27,000 to 33,000 pounds per square inch. Its elongation from 16 to 20 per cent as a rule and its brinell hardness number is between 50 and 60.

Melt Bronze in Cupola

At times we have occasion to make large bronze castings which are too heavy for our brass furnace equipment, and as we have a small cupola it has occurred to us that we might use this for melting the metal. We would like to know what air pressure is required in melting the bronze.

Cupolas have been used with success for melting both bronze and copper, but they are not the ideal furnace for such work as the metal comes into intimate contact with the fuel and is thus given a wonderful opportunity to absorb impurities such as sulphur, which reduces copper oxides with formation of gas, soluble in the copper. However, the cupola can be used for occasional melting, and the thing to strive for is rapid melting in order to get the metal down and away from contact with the coke. For this reason the blast pressure should be the same as for cast iron, and the mold, or molds should be ready ahead of the metal. In the case of melting bronze, have the alloy ready for the cupola in the shape of ingots, which can be bought to specification. Some cupola bronze melters sandwich the bronze, or copper as the case may be, between layers of charcoal, interposing the latter between the coke and the bronze. Whether this does any good, is an open question. The metal should come down quickly and be hot, and then tapped into a well-heated ladle with a few ounces of phosphor copper per hundred pounds of bronze on the bottom. About 2 ounces phosphor copper per hundred pounds of metal should be sufficient. The procedure is the same as for cast iron. As the bronze will not be in contact with the fuel more than a few minutes, no time is given for contamination. An oxidizing atmosphere in the cupola will do no harm when the metal is not sulphurized, and no harm possibly can arise from rapid melting.

Makes Metallic Packing

We are making metallic packings of an alloy of copper 60 per cent; lead 40 per cent, which are used against superheated steam at a maximum temperature of about 500 degrees Fahr. The rings are cast in cast iron chills, and you will note from the sample showing a fractured surface, how well the copper and lead are amalgamated. However, we experience much trouble from the rings when they are in service as they become brittle and break into small pieces. The rings also are found to be greatly corroded, and we are sending sample of such a casting that has been in service several months. We would like you to advise us how to improve this metal so it will stand up in service, or suggest a new alloy that would be better for such work and its method of manufacture.

As the melting point of lead is only some 120 degrees above the working temperature mentioned and lead and copper merely are mixed mechanically, it is not surprising the alloy is unfitted for the service it is being put to. The corroded portion of the sample of a casting shows copper on analysis but no lead. Therefore, it appears that the lead is driven out by contact with the hot steam. It will be an expensive proposition to undertake research work to develop a suitable alloy for this purpose, but we believe it should be done, as the present alloy is not at all suitable. An alloy of this nature of course would be commercially valuable, both to the manufacturers and to those using the same. The lead to us seems to be the indispensible metal of the combination, and if we were undertaking such a work, we should look for some substitute for the copper, that would form an alloy with the lead, and at the same time greatly raise its melting point.

Can Used Sand Be Reclaimed-VI

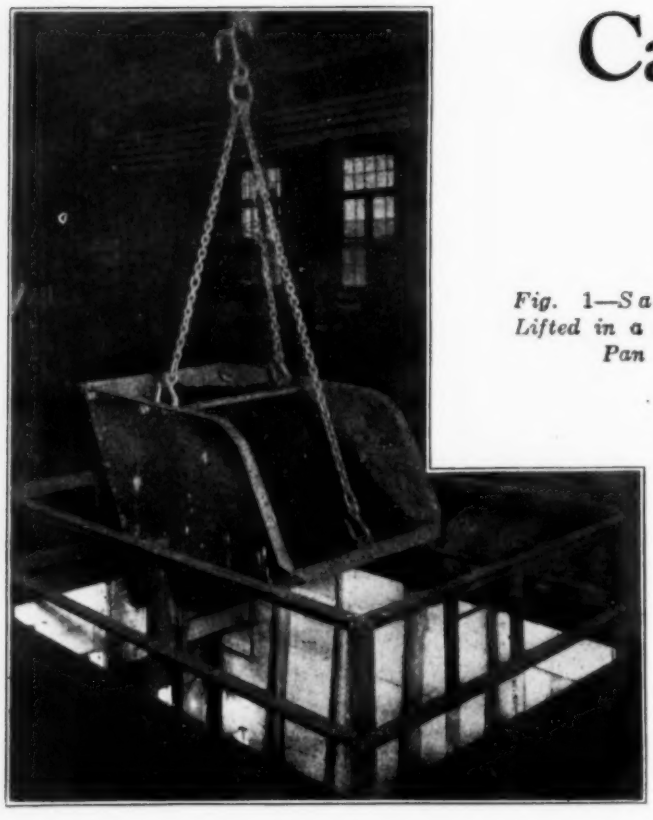


Fig. 1—Sand Is Lifted in a Special Pan

Eastern Shops Have Adopted Practice of Adding Clay Bond To Rejuvenate Burnt Out Sand Heaps —Mechanical Mixing Employed Exclusively

By Pat Dwyer

WHILE collecting material and preparing this series of articles, the writer assumed that the only readers who might be interested were those included in the ranks of practical foundrymen. No necessity was felt for introducing either theoretical or elementary factors into the discussion. For example while the title possibly might mislead a person not familiar with foundry practice into the belief that reference was made to sand that only had been used once, practical foundrymen know that the term *used sand* applies only to sand that apparently has passed its period of usefulness and is scheduled to be hauled to the dump.

Shopmen know that sand may be used not only once but many times before its original period of usefulness comes to an end. Without exception they are familiar with the practice of adding new sand to the shop supply when it shows signs of weakening and to a considerable extent they have noted that the life of sand that has been treated mechanically exceeds that of sand simply cut over by hand.

A comparatively small number of foundry pioneers have gone a step farther. They have abandoned the use of new sand either in whole or in part as a reviving agent and have substituted clay. They proceed on the theory that since the primary purpose of adding new sand is to restore the bond, it is more economical to add that bond in concentrated form. The bonding element in new sand rarely exceeds 12 per cent, while clay is practically all bond.

Where reference was made to the possibilities of reclaiming old sand, that reference was connected definitely and directly with old sand or used sand that was not susceptible to further rejuvenating treatment in the usual manner. In ordinary foundry terms the reference was meant for sand that "Had all the life burned out of it." To lead up to this point properly it was necessary to review the field briefly and comment to some extent on prevailing practice. A survey conducted partly by correspondence and partly by personal observation indicated that the majority of foundrymen still maintain a *show-me* attitude in relation to any improvement in their present method of keeping their sand in workable condition. Where these men have been willing to spend a little money for a demonstration they in many cases have become enthusistic converts, the degree of enthusiasm depending on the amount of saving effected through the adoption of suitable equipment and methods.

Improved Practice

In many instances the introduction of a single piece of sand handling equipment into a foundry has been followed by a comprehensive policy of economy and conservation. Exceptions are found to every rule and machinery will continue to be abused so long as no intelligent supervision is observed. Co-operation of effort is required in the foundry as in every other manufacturing establishment and owing to the intimate multiplicity of detail involved in the production of castings, any attempt to develop and maintain that co-operation means intensive and constant vigilance on the part of the foudry superintendent.

The average foundry superintendent is not a crusader. He has no particular ambition to emulate the example of the young man who carried the Excelsior banner to the top of the hill and then dropped dead as a result of his efforts. Introduction of new equipment and new methods means a period of extra activity and the average person is not wildly enthusiastic about anything that will cause him trouble, either mental, physical or both. If the shop is jogging along under a comfortable routine he is averse to disturbing it. Makers of all kinds of foundry equip-

Machines Used

This is the sixth and concluding article of a series prepared by Mr. Dwyer dealing with present day foundry practice in relation to molding sand. The series began with the March 1 issue of THE FOUNDRY *and ran consecutively thereafter. Wide interest expressed in the mechanical aids and equipment used in treating, preparing and reconditioning sand has induced the author to prepare a supplementary descriptive article which will appear in an early issue.*

THE EDITORS

ment including sand mixing machinery find that this spirit of resistance, whether it is active or merely passive, is the most difficult factor to overcome in their effort to introduce their apparatus.

This is particularly true with some of the older foundries and the older foundrymen. Almost invariably new foundries are equipped with the latest in mechanical equipment and this is only natural since the builders not only plan to equal the best at the current period, but also plan to the best of their ability to anticipate the demands of the future. Time was when an empty shed, a pile of sand, a bricked up shell of an old boiler and a few wood flasks were considered a sufficient foundation on which to start a foundry. That time as one of our famous newspaper authors tells us, is gone forever. Today the cost of a modernly built and equipped foundry may run over $1,000,000.

Valuable Experience

The foregoing is not to be taken as meaning that all old or comparatively old foundries are obsolete. Far from it. The majority of the foundries engaged in the production of heavy gray iron and steel machinery castings were built, 20, 25 and even more than 30 years ago. They were constructed along a new design to take advantage of the electric traveling crane then newly introduced. With the exception of adding molding machines and improved types of sand mixing machines, these foundries have not changed their method of operation to any great extent. Nearly all the large foundries built in recent years have been connected with the automotive industry, or with some form of industry which lends itself to mass production and consequently the sand handling problem has received the consideration warranted by its importance.

An extensive survey of the field usually is made by the projectors of a new foundry and as a result the equipment and methods adopted may be accepted as representing the crystallized experiences of men engaged in many plants, modified perhaps to some extent to meet local requirements. Where progressive men are in charge of older plants the practice at any given time represents the result of constant experiment and endeavor to cut costs by the adoption of what at times may be regarded as radical measures.

Earlier articles in this series have dealt with the almost universal practice of adding new sand either directly to the heaps or through the facing. Statistics compiled from various sources indicate that no standard exists to regulate the amount necessary to keep the sand on the floors in good working condition. On the basis of casting production the sand consumption ranged from 1 to 4, up to 1 to 30 with the average about 1 to 10. Reference also was made to the unsatisfactory results of spasmodic efforts to clean old burned molding and core sand and reclaim it by the addition of artificial binder. Due cognizance was taken of the fact that in many instances the introduction of suitable sand blending machinery had increased the *usability* of sand to such an extent that the amount of new sand required to maintain the bond had been cut down materially.

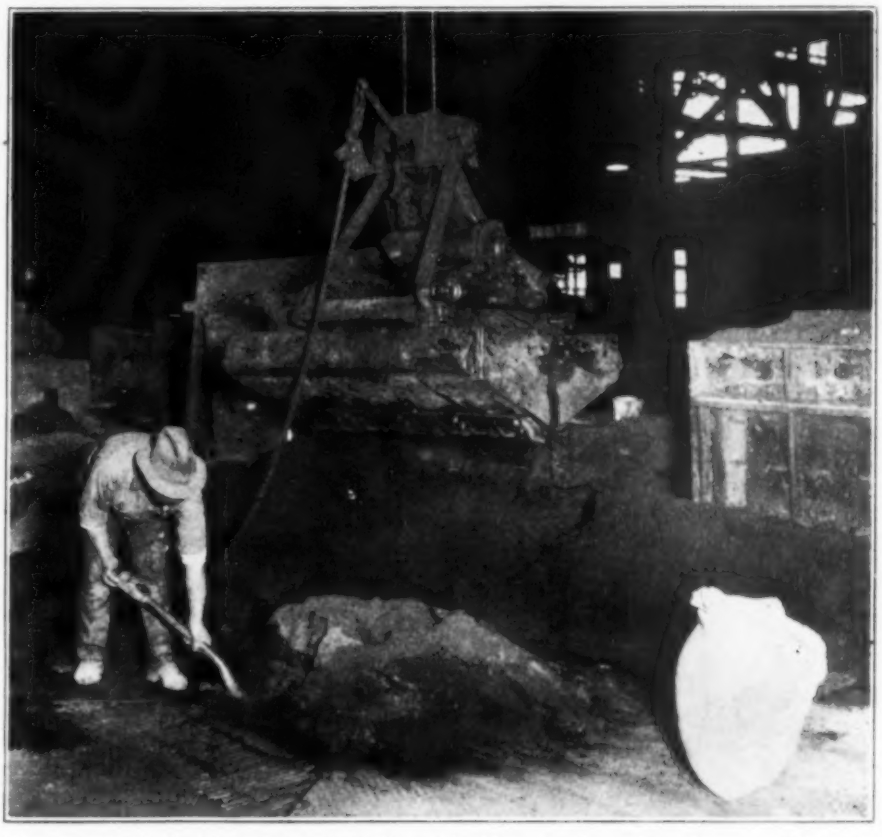


Fig. 2—Sand Is Shoveled Through a Grating in the Floor into a Muller in the Pit

In view of the foregoing and many other items which need not necessarily be enumerated again, the measure of success which recently has crowned the efforts of several prominent foundries in reclaiming sand by the addition of clay instead of sand, seems worthy of comment. In several of these shops new sand has been eliminated entirely while in others new sand additions are confined to the material used on certain floors. The remainder of the sand in the foundry is kept in fit condition by periodic additions of small quantities of clay. The change from one method of rejuvenation to another has been going on for periods ranging from six months to two years.

The practice pursued at the Brown Car Wheel Co., Buffalo already has been cited in the second article of the present series published in the March 15 issue of THE FOUNDRY. Other nationally known foundries in which the same or somewhat similar practice is observed and which have been selected for illustration include the Southern Wheel Co., the Gleason Works and the Symington Co., Rochester, N. Y.; the Worthington Pump and Machinery Corp., and the Hunt-Spiller Mfg. Corp., Boston; United Shoe Machinery Co., Beverly, Mass.; Brown & Sharpe Mfg. Co., Providence, R. I. The first three use nothing but clay to keep the sand in condition. The remaining four have not yet completely abandoned the use of new sand, but are working toward that end.

Variety is presented in the list which includes a malleable foundry which specializes in railroad castings, two machine tool foundries, one foundry engaged in the manufacture of pump castings, one car wheel shop, one engaged in the manufacture of special machinery and one in the production of rings of various kinds that are poured from air furnace iron. The general method pursued in treating the sand is the same in all cases, but minor changes in detail

to conform to local conditions present points of interest.

At the Southern car wheel foundry no new sand has been added to the supply for approximately 2 years and no old sand has been discarded during the same period. A sufficient amount of clay has been added to maintain the bond and to make up for the relatively small quantity of sand that is carried away as dust. The clay is added through the facing which is mixed in a muller type mixer, also by placing a definitely measured quantity on top of each cope before the flask is shaken out. A close check is kept on the condition of the sand and the amount of clay placed on top of the copes is varied occasionally depending on whether the sand shows a marked tendency toward abnormal openness or closeness. The usual amount required is 0.50 per cent, or 1 measure of clay to 200 measures of sand in the facing and about 1.00 per cent or 10 pounds of clay to each mold.

Experience of the Symington Co., Rochester, N. Y., would seem to indicate that the use of clay instead of new sand has been firmly established. The experiment has been carried along on an extensive scale which may be inferred from the fact that the output of journal boxes and other castings connected with the railroad industry amounted to 125 tons per day.

This company during 1924 used 6865 tons of new molding sand or 695 pounds of new sand for each ton of castings produced. No new sand was used during 1925. Its place was taken by 642 tons of a special clay supplied by a local interest and this works out at a ratio of 75 pounds of bonding material to each ton of castings produced in 1925. No useful purpose would be served by quoting the actual cost of each kind of material. Each foundryman may draw his own conclusions based on the cost of either sand or clay delivered to his plant and bearing in mind that each ton of clay is equivalent to about 10 tons of sand for bonding purpose.

A considerable quantity of the clay was added loosely to the heaps and cut over by hand. The management claims that still further economies might have been effected if conditions permitted all the sand to be put through a mulling process. Loading and unloading expense, freight, demurrage and complications sometimes resulting from delay in shipment, all are important factors where large quantities of sand are handled. Taking the year as a whole the Symington Co., states that 1 ton of clay replaced 8 tons of new sand coming into the plant. However, since 1 ton of used sand had to be removed from the foundry for each ton of new sand that was brought in, the tonnage of sand in and out of the foundry was reduced by 16 tons per day.

Another interesting feature in connection with the situation is that the percentage of defective castings was reduced to about two thirds of what it was in the year preceding the adoption of clay as a reviving agent. A large measure of this saving undoubtedly was due to the fact that a much closer supervision was kept over the sand and incidentally over every other item in the cycle of casting production.

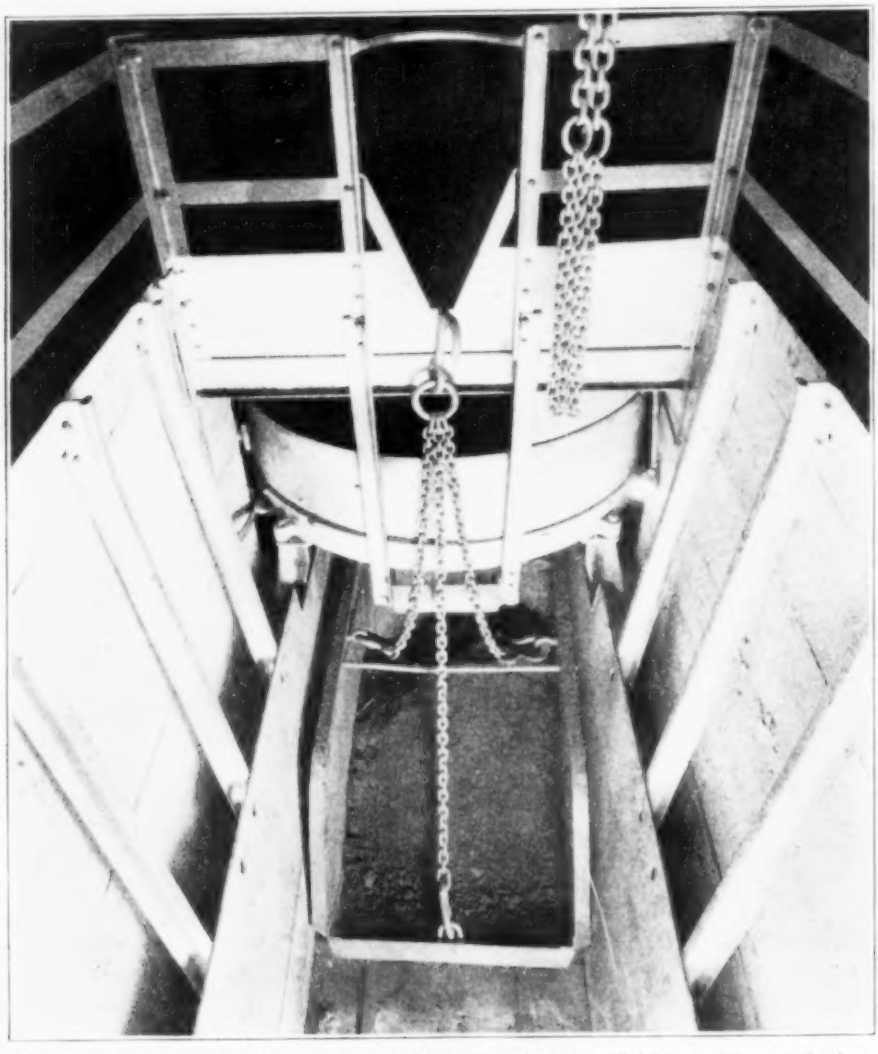


Fig. 3—Prepared Sand from the Muller Is Discharged into a Pan and then Conveyed by the Crane to any Desired Point

Uniformity Lacking

Whitehead Brothers Co., Providence, maintains an elaborately equipped laboratory at the plant of the Symington Co., for investigation of the properties of foundry sands from all known deposits. It is under the direction of H. B. Hanley an experienced consulting foundry chemist of recognized standing who has been a frequent contributor of articles on sand to THE FOUNDRY and the *Transactions* of the American Foundrymen's association. An exceptionally complete series on the subject of *Judging Sands for Foundry Use*, written in collaboration with H. R. Simonds, was published in four issues of THE FOUNDRY Sept. 15, Oct. 1, Nov. 1 and Nov. 15, 1920.

The following figures taken from recent records at the laboratory covering a great number of foundries indicate the almost chaotic condition which prevails among sand users. They also show that an almost infinite amount of time and patience will be required to make a sufficient number of tests and correlate the results so that a definite set of standards may be accepted and adopted. Individual members of the group of foundries included in this report are scattered over a wide area and depend for their sand supply on widely separated deposits. Each one of the foundries is a going concern, operating in a

satisfactory manner and turning out a saleable product.

Cost of new sand delivered ranges from $1.51 to $5.22 per ton, but as if to prove the almost utter impracticability of attempting to draw reasonable inferences from published figures, another column in the same report shows that the high cost sand is mixed in the proportion of 75 parts of new sand to 25 parts of old sand. The proportion of the $1.51 sand considered necessary in a facing mixture is not given, but the proportion varies with other sands on the list up to a maximum of 93 parts of old sand to 7 parts of new sand. The average is about 50-50.

Model of Efficiency

Variation in the total consumption of new sand based on the casting output is just as apparent here as it was in the general report incorporated in the fourth article in this series which was published in the April 15 issue of THE FOUNDRY. It ranges from 140 to 1000 pounds per ton. To some extent this discrepancy is due to the difference in the bonding element in sands from different deposits. Also, sand used continuously on heavy castings needs more constant renewal than sand used for making, for example, saddlery hardware. Even after making allowance for these two factors it is apparent that the field for standardization on the proper amount of new sand to use, still is wide open. A summary of the averages of sand from 42 foundries in relation to the bond and permeability is shown in the accompanying table on this page.

The Gleason Works, built of gray stone along severely classical lines and covered in summer with the luxuriant growth of the Virginia creeper is one of the show places of Rochester. The foundry building is set apart from the remainder of the buildings comprising the entire group. The interior is whitewashed, the windows are kept clean and in all respects a favorable impression is gained from an outside view. While not necessarily inevitable, still it is not at all surprising to find that the shop practice is in conformity with the environment.

Experience gained over a period of many years has convinced the foundry superintendent in this plant that the more sand is burned the more nearly it approaches the perfect molding material. Each time it is heated a certain amount of organic, gas producing material is burned out and the hazard of blowholes and dirty castings is reduced to a certain extent. However, like many other operations in the foundry the reduction of one element involves the automatic loss of others which really are needed. Thus in this case by the time the organic material is completely burned out, the bonding element has disappeared and while the sand is in that condition it cannot be rammed or made to retain the shape of a mold. A compromise is effected by using nothing but old sand bonded with a minimum of clay.

Considerable experimenting over an extended period was required to decide just where the line of demarcation lay between sand that would work satisfactorily and sand that would cause trouble on account of being either too open or too close. Open sand caused delay in the extra time required to reinforce it, especially in the cope. Later the same sand dropped after the mold was closed, or washed away in front of the stream of metal. The close sand caused the iron to boil and bubble, to fill the casting with blowholes. Sand from cuts and scabs floated through the castings and formed dirty and porous areas on the cope surface and elsewhere.

Establish Ratio

Eventually the system steadied down to a point where the bond in the sand, also the permeability are maintained at the desired point by adding 29 pounds of clay to each 700-pound batch of facing sand prepared in the muller. The facing sand is used perhaps a little more freely than would be the case where ordinary sand is employed, but that is only a minor detail and adds practically nothing to the cost of the castings.

No molding sand is thrown away. Occasionally when the sand shows a tendency to tighten up, a little old burned coresand or sand from the sandblast room is introduced into the facing sand mixture. Most of the used coresand is crushed, screened and placed again in the core-sand mixture. Many of the cores are of the large and chunky type and lend themselves readily to the absorption of an indifferent grade of sand. In this connection it is interesting to note that the most satisfactory sand for cores surrounded or almost entirely surrounded by large bodies of metal, is a mixture of burned core sand and spent sand from the sandblast room bonded with just sufficient liquid binder to hold the sand together after having been dried to the scorching point in the oven.

Although the prepared sand feels coarser to the touch than the grade of sand usually employed in foundries engaged in the production of a similar or closely related line of castings, still the surface of the castings is as clean and smooth as stove-plate. The ordinary foundryman is not unduly interested in theories. If a certain kind of sand produces a smooth casting, he does not care why, how or wherefore. There is the sand and there is the casting and these are the only two factors worthy of consideration.

However, for the benefit of those who may be interested in the theory, it will be of interest to note the views propounded by two scientifically trained men who have carried on extensive sand investigation during recent years. The first man claims that smooth castings may be produced from any suitable grade of sand fine or coarse, provided the grains lie close enough together to present a practically solid front to the metal. With fine sand this effect is secured automatically. The same result may be had with coarse sand if sufficient fine material is present to fill the interstices.

Two Theories

The second man refers to the so-called snowball theory to explain why the sand grains retain approximately their original shape in spite of the severe service and high temperature to which at times they are subjected. In the original state each grain of molding sand is covered with a film of clay or bonding material. The thickness of this film varies according to whether the sand is *fat* or *lean*. Each time the sand is used this film is destroyed in that portion which is raised to a high temperature

Averages of Sands from 42 Foundries

	Bond			Permeability		
	4% moisture	6% moisture	8% moisture	4% moisture	6% moisture	8% moisture
Average—New Sand—Coarse	158	178	187	124	112	97
Average—New Sand—Medium	163	184	186	32	33	30
Average—New Sand—Fine	160	181	186	10	11	11
Average—Heap Sands	124	143	142	36	33	31
Average—Facing Sands	132	150	151	32	33	32

from contact with the casting. The water is evaporated and the clay film loses its grip on the grain of sand. When clay is added to sand of this kind the grains take on a new coating similar to the first.

A different condition obtains in the portion of the mold where the sand is not affected by the heat of the casting. Manifestly the clay coating on the grains of sand is not disturbed. Therefore one might be justified in assuming that when an additional supply of clay is introduced into a batch of sand the grains acquire a thicker coating and eventually the heap will consist of a mass of small pellets containing more clay than sand.

The investigator referred to previously claims that the foregoing change does not take place. A second or a third coating of clay may adhere to the grains, but after that the attraction is not sufficient to hold it and the clay splits and crumbles off while the sand is going through the mulling process. The clay thus discarded by some grains is available for coating grains that may be bare and in that way the actual amount of new clay may be reduced from time to time.

Mixing Equipment

Clay instead of new sand is used extensively in the iron foundry of the Worthington Pump & Machinery Corp., Cambridge, Mass. It is added through the facing sand which is prepared and distributed as shown in the accompanying illustrations, Figs. 1, 2 and 3. The sand mixer is located in a pit beneath the floor where it is loaded easily through a grating. The pile of sand in the vicinity of the grating is replenished constantly by a grab bucket suspended from a crane and usually is pitched by hand through an upright portable screen before it is shoveled through the grating into the pan beneath. Between batches of facing, or a certain hours of the day, depending on local conditions, the apparatus is utilized to mix coresand.

The ingenious device for handling the loaded pan may be noted in Figs. 1 and 3. A triple chain sling with one long and two short members is attached to eye bolts in the pan. The ring where the three members converge is attached to a double hook to facilitate easy and rapid hooking and unhooking of the crane. In Fig. 3 the hook may be observed in a pocket provided for the purpose in the pit wall. A skilled craneman can engage and disengage this hook without any assistance from the floor. The pictures are self explanatory and really need no comment.

Experiments to determine the most effective means of mixing and blending foundry facing sand have been carried on for a number of years at the plant of the Hunt Spiller Mfg. Corp., Boston, under the direction of R. F. Harrington. Many notable papers on the subject have been contributed by Mr. Harrington to the *Transactions* of the American Foundrymen's association and also have been published in the pages of THE FOUNDRY. The two latest appeared in the Aug. 1, 1923 and March 15, 1925 numbers respectively. Mr. Harrington who is a prominent member of the joint committee on molding sand research expects to present another paper before the international congress of foundrymen to be held in Detroit Sept. 27-Oct. 1, 1926.

Experimental work with clay still is under way and complete data are not yet available for publication. The use of new sand has not been discontinued altogether, but the work has progressed to a point where the sand has been replaced with clay and old sand to a considerable extent. For example a former mixture of 75 per cent old sand, 23 per cent Millville gravel and 2 per cent coal dust has been replaced with a standard mixture containing 92.7 per cent old sand, 4.2 per cent Millville gravel, 2.1 per cent clay, 1.00 per cent sea coal.

Added Through Facing

Brown & Sharpe Mfg. Co., Providence, R. I., gradually has been introducing clay into its sand heaps. At the time this report was prepared the sand on approximately 40 per cent of the floors had been treated with clay with a corresponding reduction in the use of new sand. A brief summary of the comprehensive records kept on this detail of foundry operation shows that while the average consumption of new sand per ton of castings in 1923, 1924, and 1925 was 551 pounds, the average for six weeks in 1926 was 242 pounds.

Several other prominent foundries throughout New England are pursuing investigation along the same line and the same is true of a number of foundries in the Chicago district, but while they claim that the results are gratifying they are not prepared at present to submit any views for publication. Interest in sand control, testing, reclamation and conservation gradually is spreading in the foundry industry. A complete knowledge of sand, its use and abuse, may not become universal among foundrymen this year or even next year, but the leaven of interest is at work and eventually a detailed knowledge of sand will be considered as necessary as an intimate acquaintance with the characteristics of metals.

Council Changes Name

At a meeting of the executive committee of the National Council of Lighting Fixture Manufacturers recently held in Cleveland, it was decided to change the name of the organization to the Association for Artistic Decorative Lighting Equipment. The plan of the association is to broaden the market for lighting equipment and unify the manufacturers of lighting fixtures and allied industries. W. M. Horn, Horn & Brannen Mfg. Co., Philadelphia is president and chairman; J. W. Schulze, Alfred Vester Sons, Inc., Providence, R. I., vice president; B. F. Klein, Kayline Co., Cleveland, treasurer; H. B. Garrett, Cleveland, secretary, and Granville P. Rogers, New York, is managing director. The general offices of the association are located at 424 Guarantee Title building, Cleveland.

Purchase Indicated

The purchase and reorganization of the J. L. Mott Co., Trenton, N. J., is heralded by the announcement that a two million dollar bond issue maturing this June will be retired and a million dollar working capital will be provided. Those behind the reorganization are Mrs. Charles A. McLean, Sir Ashley Sparks, James H. Post, all of New York, Matthew Schammel, Trenton, N. J., and Frederick S. Blackall, Woonsocket, R. I. Herbert Noble, New York, is attorney. The Mott company has been in the hands of receivers since June, 1924.

Foundry Starts Operation

Hartford Foundry Corp., has started operations in the former plant of the National Machinery Co., Wethersfield, Conn. The head of the project is Edgar Spencer, formerly superintendent of the Connecticut Foundry Co., Rocky Hill, Conn.

Spring Meeting Held

Tri-City Technical council and the Tri-City Manufacturers' association recently held a joint meeting at the Black Hawk hotel, Davenport. A B. Greenleaf, Peoples Gas Light & Coke Co., Chicago, gave an illustrated lecture on the use of gas in industry.

Bill Hears A Sad Tale of Two Cities

By Pat Dwyer

TO A certain extent I am willing to admit that I might have been a little more careful. I should have concentrated more deeply, kept my mind firmly glued on one point instead of allowing it to wander around promiscuously while depending on my subconscious mind to take care of detail in making a change of clothing. However, I still maintain that the mistake was perfectly natural and the claim made by a certain member of the family that I should have a guardian appointed to watch me, is utterly without foundation. Going into the subject a little more deeply I am almost inclined to the opinion that the luxurious habits of the present age rather than any laxity on my part are responsible for the unfortunate experience. In the good old days, when I only had one suit, the accident positively could not have happened. Now that I have two, the embarrassing possibility of a recurrence hangs constantly over my head suspended by a single hair like the sword of Damocles. Patience, gentle reader, patience. 'Tis a wonderful virture and worthy of earnest cultivation. I ought to know. I had to practice it for 5 hours continuously on this occasion to which I refer. Therefore, I do not think I am imposing too severe a strain by asking you to wait a minute before we carry on. You probably are sitting at your ease comfortably fed and clothed, with a cigaret dangling from your lip while I had to work like a slave without either the price of a smoke or a breakfast and without any positive assurance of receiving either the one or the other first aid you might say, in the immediate future. At one time or another I have landed in many strange towns, but this was the first occasion on which I found myself totally broke financially, utterly flattened out, a total loss. To begin at the beginning, which after all is the proper way and one which I practice invariably, unless of course when certain circumstances compel me to present a word or two of preliminary explanation, I had occasion recently to visit the neighboring city of Detroit on a little professional assignment. I might go into further detail on this subject touching on the why and the how and the wherefore, but as I have just said I do not favor roundabout methods in telling a story. Direct and to the point. That is my motto!

I realize fully that readers have their rights and no writer is justified in wasting time and space deliberately in setting down inconsequential details that have no direct bearing on the point at issue. When I read, I like to read something in which the author leaves me free to exercise my own imagination. Something in which I can fill in the details according to the dictates of my fancy. In perfect accordance with the well-known saying that what is sauce for the goose is applesauce for the goose's gentleman friend, I freely concede my reader's right to the same privilege I claim for myself.

Now that we have arrived at a common understanding, with all debatable material cleared away or swept under the rug, I can commence at the beginning in full anticipation of continuing without interruption until I arrive eventually at an orderly and logical conclusion.

You probably have noticed in your own experience that nothing is more disconcerting to the even and gradual development of a narrative, than a series of interruptions. For that reason, as I explained previously, I invariably omit any ambiguous or mysterious references or any long drawn out preamble that possibly might distract attention from the main theme. Some writers have a highly annoying habit of rambling all around the fringe of a subject before they get down to work. The temptation, of course, is strong to try a few practice swings before knocking the ball for a flight down the fairway, but I am happy to say that up to the present I have resisted successfully any insidious temptation of that character. To continue the simile a little farther I know exactly where I am going to hit the bull—the ball, my error, before I commence and therefore I waste neither my time nor yours dancing around the tee. If any gentleman thinks the foregoing word or two is unnecessary I would respectfully point out that a certain amount of preparation is required before starting a job. Experienced foundrymen readily will recognize that the cinder bed must be laid and the vent pipes adjusted before the pattern is bedded in the pit. Provision must be made in advance for the gas and hot air generated later while the mold is filling with metal. Are you all set with your skimmer ready to touch off

How To Start the Day Wrong

the vents? All right, Oscar. Tip her and keep the runner basin full!

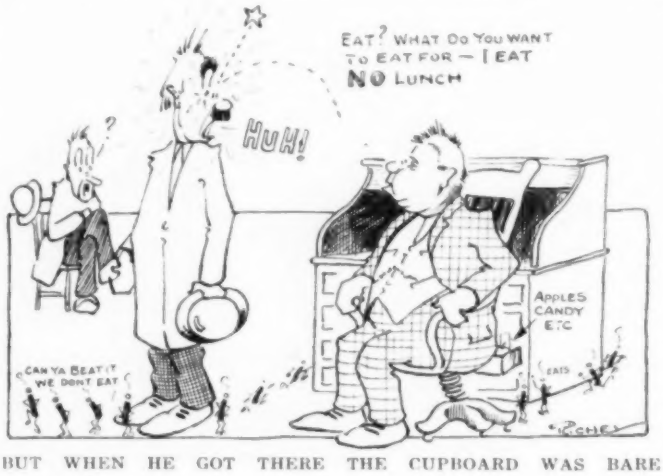
About 9 p. m. I retired to the bedroom in which I am supposed to have a half interest. Supposed is good. In a closet provided with two dozen hooks all my clothes hang on one. Even at that, sometimes I have to remove two or three strange garments before I can find mine. At various occasions in my passage through this vale of tears I have indulged in day dreams concerning what I should do in the event that I become independently wealthy. One thing is certain, should I ever arrive at that stage, I shall have a clothes closet all to myself equipped with at least three hooks, one for my coat, one for my vest and one for the trousers. I may even have one for a hat and another for an overcoat, but as I usually leave these downstairs I will not insist, except merely for show. I shall paint the effigy of a skull and crossbones on the door and plant a spring gun inside for the benefit of prowlers who seek to usurp any of the hooks.

On this particular night I retired to the bedroom to exchange the toil worn garments of the day for the suit in which I go visiting. I dumped the contents of my pockets on the bed, money, railroad ticket, smoking materials, papers and all the miscellaneous junk with which the average citizen burdens himself. No wonder the majority of men are afflicted with hump backs and bandy legs.

Having made the change, I selected the articles I should need on the trip and distributed them in the pockets of the suit I was wearing. I replaced all the other articles in the pockets of the suit I had discarded and hung the garments on my single hook. Then I proceeded blithely downstairs, picked up the bag sight unseen, kissed any members of the family willing to submit and departed for the railroad station.

Traveling all night in a sleeper presents little or no opportunity for spending money. Therefore, I had no occasion to check up on the available assets until previous to leaving the train in the morning. As I stated previously I have been addicted all my life to carrying a lot of miscellanous junk around in my pockets, but up to the present I have resisted successfully the temptation to add one of those cute little change purses to the collection. At the risk of laying myself wide open to the predatory designs of nimble fingered gentlemen who pick up a comfortable competence by ignoring the difference between mine and thine, I confess that I carry all my small change in the right hand pocket of my trousers. On the few occasions when I find myself in the possession of a few stray bills, I pack them in the left hand pocket.

Plunging my hand in the right-hand pocket, I found I had enough coin of the realm to bestow a small gratuity on the porter and pay car fare down to Mr. Statler's modest hostelry. The morning was fine and since I had plenty of time I toyed for a few moments tentatively with the idea of walking. Fortunately a car was waiting at the stop in front of the station and the decision automatically was taken out of my hands. I shudder to contemplate the possible result if the weather had been inclement and I had taken a taxi. Probably my mutilated body would have been found in an alley or tucked away carelessly in a manhole several days later. Taxi drivers are notoriously lacking in the finer artistic sensibilities.



BUT WHEN HE GOT THERE THE CUPBOARD WAS BARE

If I was inclined to the reprehensible habit of straying away from the main theme I might dwell for some time on this point and speculate on the activities of the police department and the newspapers in building up theories and destroying them day after day until interest of the public no longer could be stimulated or until some other citizen, dead or alive, furnished a more interesting subject. However, as I think I mentioned previously I do not approve of telling a story in that manner. I believe in presenting the bare facts simply and concisely and in the fewest possible words.

Of course, I recognize that the police department and the newspapers have an established and perhaps necessary place in our modern community form of existence, but since you are just as anxious as I am to escape the clutches of one and the attention of the other I do not believe that any useful purpose will be served by introducing them into this plain little narrative. With this point cleared up satisfactorily, let us continue. If any gentleman cares to ask any questions later I shall be glad to answer to the best of my ability.

Arrived in front of the desk I found several prospective guests ahead of me. Through force of habit while standing at ease, I opened my overcoat and plunged both hands in my trouser pockets. Naturally I was not surprised when the the fingers of my right hand came in contact with three or four nickels, but my heart turned upside down and then stopped beating when I found that the left pocket was as empty as a last year's bird nest. My status as a prospective guest automatically disappeared and I sneaked off to a quiet corner of the lobby where I hoped I might be allowed to die in peace.

A few minutes rest and the attendant calm reflection convinced me that the situation was not utterly hopeless. Detroit may be open in some respects, but it is far from being one of the great open spaces where men are men who have to exist for unbelievable periods on a can of beans and a few mouthfuls of snow. Food was here in abundance, but unfortunately I could think of no plausible scheme for collecting any of it. I strolled past the dining room door and inhaled a few appetizing sniffs. It may have been imagination, but I fancied the waiters eyed me suspiciously. I enjoyed a small measure of comfort in looking at several beefy citizens gobbling down their breakfasts and in hoping fervently that they choked in the process.

I did not know whether I had lost the money or had it stolen, but finally I decided to brave the ridicule of the home office and telegraphed—collect—for a fresh supply. Then I went off as cheerfully as possible under the circumstances about the master's business, hoping against hope that the man with whom I had an appointment would invite me to lunch. To my dismay I found he was on a diet and did not take any lunch at noon. I spent the last nickel I had in the world to get back to the hotel, my mind filled with gloomy forebodings of what would happen should I find no message.

No forlorn or shipwrecked sailor, no lonely castaway on a desert isle

ever saluted a sail on the horizon with greater joy than I welcomed the envelope handed me by the life-saving, telegraph girl. I sailed into the dining room walking on air and when I emerged an hour later I would not have traded places with the mayor of the city.

Only one fly remained in the ointment. All the way home I kept speculating on whether I had lost the money or inadvertently had left it at home when I changed clothes. According to my usual custom I called the house when I arrived at the station. "Oh!" said the voice at the other end of the wire "You're there, are ycu? How did you pay your bills?" Then I knew that once more God was in his heaven and all was well with the world. I fervently ejaculated "HOT DOG" and hung up the receiver.

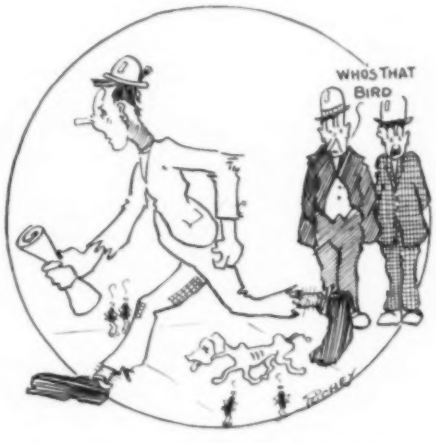
Bill came in the following night and I related the experience. He seemed to think I had hade a mountain out of a molehill. He said he had landed broke a thousand times in various towns at one time or another, but he never had worried over a trifle of that character.

"The only thing that ever worries me" said Bill "Is when castings continually go bad and I can't find the reason. Through long experience I have learned that other foundrymen suffer from the same disease. Only the other day I had an inquiry from a lad whose piston rings were dirty in spite of all his precautions. He forwarded for my inspection a piece of a 21-inch piston ring containing at one point a mass of dirty material which rendered the ring unfit for use. He said the rings were made in many sizes but all to a uniform depth of about 8 inches in open sand molds. The metal is poured in the center and distributed to the mold cavity through a number of gates ranging from 4 to 12, depending on the diameter of the ring.

"This man operates a general jobbing and repair shop in a section of the country where the freight rate for a long haul converts pig iron into a luxury. Fairly good scrap may be had at a reasonable rate. Therefore, he melts an all scrap mixture, taps the metal into a mixing ladle where it is treated with a quantity of a proprietary flux. The sample submitted for examination was taken from a partly machined ring and the grain and fracture of the metal presented a favorable appearance. On account of the dirt inclusions the losses sometimes ran as high as 50 per cent of the available stock in the casting. He wanted to know where this dirt came from and how it could be prevented.

"Usually two courses of action are open to the foundryman who finds a dirty spot or a number of these spots in a casting. One is to adopt precautionary measures to prevent dirt from floating in with the iron on the next casting. The second is to accept the dirt floating on the casting as a natural occurrence and manipulate it in a manner that will cause it to float to the top. In this particular instance with a plain ring poured in an open sand mold I pointed out that the second method is the more economical and is perfectly satisfactory.

"Dirt in the casting is due partly to the slag which results from the addition of the fluxing agent and which is not thoroughly skimmed off before the iron is poured, but it is due principally to the dust and small particles of sand that are washed ahead of the stream of metal entering the mold. The runner and gates on an open sand mold become dry and dusty if made up several hours before the iron is poured. This material floats a certain distance on top of the rising



THE BOY IS GROWING OUT OF HIS CLOTHES EVERY DAY

metal in the mold. In exceptional instances it floats to the top of the mold. Usually it touches the inside or outside wall of the mold and is held by friction while the thin, liquid iron floats past and surrounds it. Any person easily may verify this statement by looking down into a ring mold while the iron is rising in it.

"The remedy is one of a number of shop kinks I picked up in a shop where pulleys were made on an extensive scale. I advised the inquirer to station a man armed with a ¼-inch rod about 4 feet in length, close to the mold where he could watch the rising iron. When he sees a lump of dirt accumulating and perhaps showing a tendency to stick to the side of the mold, all he has to do is to touch it with the end of the rod to free it from contact and keep it floating on top of the iron. By running the rod down into the metal and stirring it around once after the mold is filled and remaining particles of foreign material will be loosened and will float to the top."

"All you think about day and night is the foundry" I complained. "I think you might express a little sympathy for my unfortunate experience."

"Nonsense" says brave Bill "You don't fast often enough. You have a long way to go before you find yourself in the position of the late skinny Artemus Ward walking down Superior avenue followed by a lean and hungry looking dog. A friend asked Art if he owned the dog. 'No' said Art, sadly. 'He thinks I belong to him. When he finds a convenient place he is going to bury me!'"

Make Personnel Change

E. H. Sniffin, former manager of the power department of the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., became assistant to the vice president effective April 2. In addition to the promotion of Mr. Sniffin, a complete reorganization of the sales department, involving the reallocation of the managing personnel and the creation of several new activities, was made known by E. D. Kilburn, vice president and general sales manager.

Also the following changes were made: Director of sales, T. J. Pace, formerly manager supply department; central station manager, G. H. Froebel, formerly manager marine department; industrial sales manager, J. M. Curtin formerly manager industrial department; transportation sales manager, M. B. Lambert, formerly manager railway department; assistant director of sales, A. C. Streamer, formerly assistant to manager supply department; generating apparatus manager, H. W. Smith, formerly general engineer; traction apparatus manager, A. J. Manson, formerly manager heavy traction division, railway department; motor apparatus manager, O. F. Stroman, formerly assistant to manager industrial department; switchgear apparatus manager, R. A. Neal, formerly head of switch section, supply department; and distribution apparatus manager, G. A. Sawin, formerly assistant to manager supply department.

Hear Training Talk

Americans generally have the erroneous belief that the royal road to advancement is through a college education said L. A. Hartley, National

Founders association, speaking before the Newark Foundrymen's association recently. He pointed out that a survey showed only 17 per cent of the men in responsible positions in the metal trades were college men; that 14.3 per cent of the important positions in the metal trades are foremanships and the only 2.3 per cent of these are held by college men. Mr. Hartley believes that men for the important positions will continue to be recruited from the shop for many years to come, and a suitable course of training should be provided to fit them for the responsibility, by establishing a definite apprenticeship course.

A committee on apprentice training of the Newark Foundrymen's association and one on employe training of the Employers Association of North Jersey will co-operate with Mr. Hartley in organizing apprentice training system in Newark. A. E. Barlow, Barlow Foundry Co., is chairman of the foundrymen's committee and Neil C. Lamont, Harrison plant, Worthington Pump & Machinery Corp., is chairman of the employer's committee.

Adequate Eye Protection Is Approved

By Walter C. King

PERHAPS there is no phase of industrial accident prevention work that stands out more prominently in the lists of both permanent partial and temporary total and permanent total disability injuries than those resulting to the eye. It is fair to assume that there is hardly a single industry in our national industrial classification that does not have within its area an eye hazard of some description. On a more detailed study of this classification, one is confronted in many instances with the facts setting forth the major number of temporary disabling accidents and the great proportion of permanent partial and total disabilities resulting in the loss of one or both eyes.

A recapitulation of workmen's compensation awarded in 1924 in the state of Pennsylvania for eye injuries sustained in 16 industries shows that 31 per cent of the injuries occurred in metal and metal product manufacturing. This represents an expenditure through these compensation awards of $312,750 for these injuries. This expenditure may be increased still further when consideration is given to the factors of hospital, medical expense and labor turnover cost, not neglecting the consideration of the pertinent factor of the economic effect of these inquries socially upon the worker and his dependents. This factor is often hard to determine, but is one of a potent nature, perhaps more so than any one of those results that are accurately ascertained in the cost sheet of management.

Curtailment and elimination of eye injuries may be obtained by analyzing the problem and approaching it from the same angle as one of production deficiency would be attacked. From the accident records a conclusion is derived, covering the number, specific cause and severity of eye injuries.

Abstracted from an article published in the annals of the American Academy of Political and Social Science. Mr. King is director of safety division, American Optical Co., New York.

The following data are taken from records of the state of Massachusetts for one year:

Caused by	Per cent
Hand tools	42
Machinery	30
Miscellaneous	11
Handling objects	9
Explosions, fires, electricity, etc.	8

A plan similar to this may be applied to the individual plant, and it will serve to illustrate the nature of the injuries from the causes sustained, producing effects that should be converted to economic factors for their application to the general plant production.

From analyses of this type, including eye accident cost, production losses, etc., plant executive orders covering the use of eye-protection devices may be drafted. Executive orders of this nature can be applied practically only when through the efforts of the safety department, the devices provided are of a design adequate to care for the hazards with the least possible discomfort to the wearer. The national safety code for the protection of the heads and eyes of industrial workers has classified protection devices as follows:

Protection for chippers, riveters, caulkers, or against trades or jobs having a severe impact hazard.

Protection for scaling, grinding, etc., or where the impact is of lesser nature.

Protection for exposure to dust and wind, or where the severity of impact is low and the efficiency of the device is its ability to protect the eyes from small particles of floating material.

Protection for babbitting, etc., or where there exists an impact hazard of a major degree combined with that of a liquid in the form of molten metal.

Protection for handling corrosive chemicals, dipping, brush coating, etc., in which elimination of liquid is to be considered from the angle of splash and atmospheric saturation.

Protection for sandblasting in which a high impact hazard of small particles is combined with an atmospheric saturation.

Protection for exposure to glare, or the elimination of both the annoyance glare created through the intensity of the visible band of the spectrum and the absorption of the injurious invisible rays.

Protection for oxyacetylene and electric welding operations, or those designed to protect through complete isolation from the transmission of the intense injurious invisible rays, particularly as applied to electric welding operations.

Each of these subdivisions is based on the specific nature of the hazard and an efficiently designed device can and should be applied. Lack of appreciation and consideration of factors by those in charge causes failure in the effective control of eye accidents. Goggles should be handled by some one familiar with their use. This person must understand what constitutes a fitted goggle so that the wearer may have the feeling of security behind the device in addition to obtaining protection.

A cheap spectacle lens in a light frame will not stand the impact of a flying piece of material nor will the injurious rays of light be absorbed by a common sun glass of varied hue. Goggles are made for specific purposes and should be given out only for the purpose intended. They must be handled the same as a production tool and cared for in the same manner.

Supplementing the introduction of efficient eye protection devices, bulletins may be used describing specific eye hazards, and rules covering the use of goggles and places in the plant or on the job where they may be obtained.

Industrial eye protection cannot be handled as an inconsequential side issue, or a necessary evil to be tolerated. It must be recognized as an economic cost factor and good management methods applied to make it an effective force in combining increased production with lowered operating costs.

Opens Supply House

A. E. Welch, formerly connected with the Sterling Wheelbarrow Co., Milwaukee, has established a foundry supply business at 490 Broadway, Milwaukee. Mr. Welsh was educated

METHODS FOR ANALYZING FERROALLOYS

FERROCHROMIUM

(*Continued from Data Sheet No.* 620)

Example.—The calculations involved are illustrated as follows: In a standardization, 190.0 cc. of the ferrous solution was used and 5.06 cc. of 0.1 *N* permanganate was required to titrate the excess

1 cc. of 0.1 *N* $K_2Cr_2O_7$ contains 0.004903 g. of $K_2Cr_2O_7$
1 g. of $K_2Cr_2O_7$ equals 203.94 cc. of 0.1 *N* $K_2Cr_2O_7$

then

$$203.94 + 5.06 = 209.0 \text{ cc. of equivalent 0.1 } N \text{ solution reduced by the ferrous solution.}$$

$$\frac{209.0}{190} = 1.100, \text{ the 0.1 } N \text{ normality factor.}$$

In standardizing through sodium oxalate, it is necessary to add the ferrous ammonium sulphate solution by means of an accurately calibrated pipette or burette instead of an automatic pipette. Transfer 100 cc. of the approximately 0.1 *N* ferrous solution to a 600-cc. beaker, dilute to 300 cc. with cold 5 per cent sulphuric acid, add 2 cc. of phosphoric acid and titrate immediately with 0.1 *N* $KMnO_4$ to a faint permanent pink color. Determine the *blank* on the same volume of water and acids and deduct. When this method is used it is necessary in the actual analysis to determine a *blank* to counteract the influence of the green color of the chromium sulphate upon the permanganate end point. This *blank* can be determined in the solution used in the analysis and is obtained as described later.

Method

Transfer 0.5000 g. of the sample of ferrochromium (dried at 105 to 110° C.) to a 30-cc. heavy-walled porcelain crucible. Samples of low-carbon ferrochromium should be crushed to pass through a No. 40 screen, while high-carbon ferrochromium and chromium metal should be reduced to pass a No. 100 screen. Add approximately 8 g. of sodium peroxide and thoroughly mix the contents of the crucible with a small rod, being careful to clean the rod, which can be done conveniently by scraping with another rod. Cover the mixture with 1 to 2 g. of sodium peroxide. Carefully fuse the contents of the covered crucible, preferably in an electric muffle heated to 600 to 700° C. Fusion for five minutes at a low red heat after the mass has melted will insure complete decomposition. When the charge has melted, the crucible should be given a slight rotary motion to stir up any unattached particles.

Place the cooled crucible and cover in a 600-cc. beaker and dissolve the contents in 200 cc. of water. When the melt has dissolved, remove the crucible and cover, add 1 g. of sodium peroxide and boil the solution ten minutes to completely decompose the excess of peroxide.

Allow the precipitate to settle and filter through a pad of ignited asbestos, preferably in a Buchner funnel. An asbestos rather than a paper filter should be used, for the alkaline solution extracts reducing matter from paper which would cause low results for chromium. Thoroughly wash the precipitate with hot water, and at no time allow the precipitate to run dry during the filtering and washing. If desired, the precipitate can be dissolved subsequently in dilute sulphuric acid and tested for chromium by adding a slight excess of sodium peroxide; the amount of chromium retained is negligible if the precipitate is filtered and washed as directed.

Cool the filtrate, acidify with 50 cc. of suphuric acid (1:1), again cool to room temperature, transfer to an 800-cc. beaker, dilute with cold water to 500 cc. and add

(*Continued on Data Sheet No.* 622)

METHODS FOR ANALYZING FERROALLOYS

FERROCHROMIUM

(*Continued from Data Sheet No.* 621)

a measured excess of ferrous ammonium sulphate. The point at which reduction is complete can be told by changes in the deep green color which is developed. The ferrous salt can be added either as an approximately 0.12 *N* solution or in weighed portions from a bottle of the well-mixed salt. If the solution of ferrous salt is used, approximately 180 cc. will be required for a 70 per cent alloy; if the salt is added, 8 g. will usually be sufficient. Titrate the excess of ferrous salt with standard 0.10 *N* potassium permanganate. The first faint permanent darkening of the clear green color is taken as the end point, which is quite sharp and well defined to the practiced eye. If the ferrous salt has been standardized against dichromate, subtract the required number of cubic centimeters of 0.1 *N* permanganate from the number of cubic centimeters of 0.1 *N* ferrous solution (obtained by multiplying the number of cubic centimeters of the approximately 0.1 *N* ferrous solution by the 0.1 *N* normality factor). The difference represents the number of cubic centimeters of 0.1 *N* ferrous solution which multiplied by 0.001733 g. gives the number of grams of chromium present.

Where the ferrous solution has been standardized against sodium oxalate, it is necessary to subtract a *blank* from the permanganate titration. This *blank* is obtained as follows: When the end point is reached and the readings have been noted, add about 5 cc. in excess of the ferrous solution and oxidize the excess of ferrous iron by adding 8 cc. of a 15 per cent solution of ammonium persulphate. *Stir the liquid vigorously for one minute.* Carefully add 0.1*N* permanganate to the solution with constant stirring until the same end point is obtained as before. The volume of permanganate required, usually 0.2 to 0.4 cc., constitutes the *blank* to be deducted from the volume of the permanganate titration. For example, in the determination of chromium in an 0.5000-g. sample, 190.0 cc. of a 0.11 *N* ferrous solution and 11.00 cc. of an 0.1 *N* permanganate (11.40 — 0.4 cc. blank) were employed.

The calculations are as follows:

$190.0 \times 1.100 = 209.0$ cc. of 0.1 *N* ferrous solution
$209.0 - 11.0 = 198.00$ cc.
$198.0 \times 0.001733 \times 2 \times 100 = 68.62$ per cent of chromium

The above calculations are given for exactly 0.1 *N* permanganate; if the permanganate is not 0.1 *N*, the volume used must be converted to the equivalent of 0.1 *N* by multiplying by the proper factor.

Determination of Carbon by the Direct Combustion Method

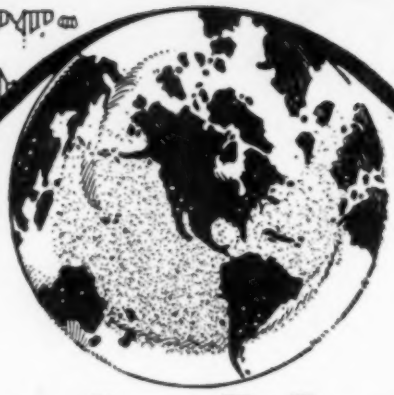
Determine carbon by the direct combustion method described in the standard methods of chemical analysis of plain carbon steel (serial designation: A 33), with the following modifications:

1. Ferrochromium alloys require a furnace temperature of 1125 to 1150 ° C. in order to yield all of the carbon in the material.

(*Concluded on Data Sheet No.* 623)

THE FOUNDRY DATA SHEET, MAY 15, 1926
Payment will be made for all contributions on foundry and pattern shop practice suitable for publication

Note—This sheet may be cut into two sections, 5 x 7 inches, and may be readily bound in note book form.



Around the World with The Foundry

Little Journeys to the homes of our readers

South Africa

BACK in the quiet hills, thousands of miles from the primrose bordered paths in the old rectory garden, simple and rugged, a massive granite boulder rests over all that is mortal of the son of an English clergyman who came to the country for the sake of his health, who was a millionaire at 19 and who lived to dominate the industrial and political affairs south of the equator for the greater part of the 30 years he spent directly and indirectly in public life. His bones long since have moldered into silent dust and mingled with the soil of the land he loved. He acquired wealth and fame; he made powerful friends and still more powerful enemies, after the fashion of strong men from time immemorial; but he did not live to see the completion of his life's dream, a railroad from the Cape to Cairo, and yet who can say that today, on that account, the great empire builder sleeps less peacefully under the immense granite boulder bearing the simple inscription—Cecil John Rhodes.

The entire installation of power plants and operating equipment in the great gold mines of the Rand and the famous diamond mines of Kimberly, were made by important European and American engineering firms. Repairs and replacements are effected by local plants and in 3 out of the 8 principal shops listed, the executives keep posted on current foundry practice through the columns of the twice-a-month FOUNDRY.

Men May Come and Men May Go, but the Wheels of Industry Keep on Turning.

"Wherever metals are cast you'll find THE FOUNDRY"

in the public schools of Milwaukee and was graduated from Wisconsin university, Madison. Wis. He was state representative of the Sterling company for several years. Mr. Welsh will represent the Wadsworth Core Machine Co., Wilters Foundry Supply Co., Steel Bound Equipment Co., and the Sterling Wheelbarrow Co.

To Form International Standards Body

A recent conference, held in the Engineering Societies building, New York, and attended by representatives from the engineering standards associations of various nations, indicates that a favorable attitude is held toward the formation of an international engineering standards association. Some co-operation has been maintained between several countries by correspondence and other informal methods, but now, due to the large scope of standardizing, it is believed that a more direct means should be established. The conference was attended by delegates from every country except Australia and Hungary.

Winter Orders Expensive To Sand Shipper

Producers and shippers of foundry sand are as willing and ready as any class of men in meeting customer's requirements, but occasionally demands are made upon their services altogether beyond reasonable limits. Practically without exception foundrymen can anticipate the amount of sand required to carry them through the winter. Knowing the difficulty of digging this sand and shipping it during the severe winter season they place their orders in the summer and fall and have them filled without trouble. Usually the sand pits are abandoned or at least partly closed down in winter, the equipment either is lying idle or under repair and the working force is scattered. Naturally, under these circumstances the sand man's expenses are increased out of all proportion when he attempts to load a car. Due to economic conditions which include competition and the unwritten law that a vender must retain the goodwill of the customer, the sand man ships sand at a loss in winter. Experience of one silica sand producer in the Middle West last winter may have been rather extreme, but nevertheless it may be regarded as fairly typical of existing conditions.

During the coldest week of the season the sand company received an urgent wire to ship a car of sand to a far eastern point. The wire was followed by a letter instructing the sand producer to cover the sand with some material to protect it from the weather while enroute. The purchasing agent apparently realized that the sand might freeze on the journey thereby entailing extra unloading expense on his company. Through some mysterious process of reasoning or perhaps through lack of reasoning he assumed that the sand would be prepared, loaded and shipped in an unfrozen condition.

The sand man collected his men, fired the boiler, loaded the sand and even covered it according to the customer's request although he realized the utter folly of the proceeding. After the rush and excitement were over he discovered that the flues in one of the boilers were leaking, several stud bolts were loose and the water was leaking into the firebox.

Damages were repaired after the car of sand had been sent on its way. The bill included $7.00 railroad fare for a boilermaker, and $30.00 for labor on an hourly base that started when he left home and continued until he returned. That was only a temporary repair job. Later, before the regular season opened an entire set of new flues had to be installed at a cost of $200. At a conservative estimate this particular car of sand cost the producer $300 for which he received about $40 from the customer.

Welders Discuss Problems

AT THE annual meeting of the American Welding society and the American Bureau of Welding, held recently in New York, much constructive criticism was offered by the various speakers. J. H. Edwards, assistant chief engineer, American Bridge Co., New York, said that many claims were made for welding, but no definite data were given to uphold these claims. What the structural engineer wants is actual information. A. G. Pack, chief inspector of locomotives for the interstate commerce commission said that the use of welding has not given uniform results on the railroads of the country. Both speakers urged a definite program of research to furnish information on the factors of welding. Comfort A. Adams, director, bureau of welding, suggested the offering of prizes to promote research and that scholarships be endowed to encourage students to study welding research. A development which is expected to result from the discussion at the meeting is the formation of a standard specification for testing welds.

Several papers were read on various phases of welding. A paper by H. D. Edwards, Carbide & Carbon Chemical Corp., New York, dealt with the welding of a lime-burning kiln, hoppers, pressure vessels, etc. L. J. Sforzini, Rochester, submitted a paper on the design of joints in piping installations. J. W. Owens, Newport News Shipbuilding & Drydock Co., Newport News, Va., read a paper on the design of joints in ship construction. S. W. Miller, Union Carbide & Carbon Research Laboratories, Long Island City, N. Y., presented a paper on the design of welded joints for pressure vessels. L. H. Burkhart, Struthers-Wells Co., Warren, Pa., delivered a paper on the design of an arc-welded pressure vessel. A paper by A. C. Vick, Detroit Range Boiler & Steel Barrel Co., Detroit, dealt with the design of welded joints for tanks and containers. Officers for the ensuing year are given in the accompanying box.

New Officers

AMERICAN WELDING SOCIETY

President
F. M. FARMER
Chief engineer, Electrical Testing Laboratories, New York

Senior Vice President
E. M. T. RYDER
Way engineer, Third Avenue Railway System, New York

Divisional Vice Presidents
R. L. BROWN
District sales manager, Metal & Thermit Corp., Boston
A. M. CANDY
Commercial engineer, Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
STUART PLUMLEY*
Managing editor, Acetylene Journal Publishing Co., Chicago

Directors
C. A. ADAMS*
Professor of electrical engineering, Harvard university, Cambridge, Mass.
H. M. HOBART
Consulting engineer, General Electric Co., Schenectady, N. Y.
A. E. GAYNOR
John A. Roebling's Sons Co., New York
A. G. BISSELL
General engineer, Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

AMERICAN BUREAU OF WELDING

Director
C. A. ADAMS*

First Vice Director
H. L. WHITTEMORE*

Second Vice Director
A. D. RISTEEN*

Secretary
WILLIAM SPRAGAGEN*

*Re-elected.

Measuring Instruments

When Properly Manipulated Assure Greater Accuracy in Either Metal or Wood Patterns

By Walter C. Ewalt

MEASUREMENTS too great for ordinary dividers may be made with the trammel points, which are shown in Fig. 1. Caliper legs, also shown in the illustration, are interchangable with the points and a pencil also may be used. The trammel points function in measuring, the same as dividers which were described in the May 1 issue of THE FOUNDRY. The points may be placed close together or extended simply by sliding the head of the trammels on a beam. There are many styles of heads. The one shown is popular and is made of bronze. A thumb screw at the top may be to tightened to hold the head in position. Two long lips each about ⅛-inch wide are located on both sides at the bottom and extend inward and slide in grooves provided in the beam. A narrower beam also may be used for lighter work if desired. In this case the lips slide against the bottom of the beam. The points are made of hardened forged steel and are fastened by a thumb screw placed on the side of the head. The points are five or six inches long and any distance from the beam to the point may be secured by adjusting up or down within those limits. This is an advantage under certain conditions. The points are made eccentric, which allows an extremely fine adjustment in close measuring. The fine adjustment is accomplished simply by rotating the points in their sockets at the head.

The caliper legs will be found convenient either when both are used in outside or inside measurements, or with a trammel point in one socket and a caliper leg in the other socket, as for instance in laying out or checking up a half pattern on a pattern or follow board. The caliper leg is placed in the flask pin hole while the point locates the pattern. The manner of using the point and leg being shown in Fig. 2.

There seems to be almost an infinite variety of calipers, one of which is the hermaphrodite, as seen in Fig. 3. One leg is made similar to a caliper and the other to the divider leg. The extension point of the divider leg is moved through the thumb screw and allows a sensitve adjustment. The wood patternmaker will find this tool serviceable, particularly in adjusting and checking up forms for multiple plaster master core-boxes as in Fig. 4, or in marking the widths and thicknesses on the plaster by running the caliper leg on one surface and marking with the point as in Fig. 5. The round end of the caliper leg readily adjusts itself to either curved or straight lines. The tool also may be used to advantage many times on wood patterns. Other uses may be seen in Fig. 6 and 7. Fig. 6 shows a method of finding the center of a block. The caliper leg is set against the ouside edges and the center marked with the point. Where a center is wanted in a hole which must be plugged, as in Fig. 7, or in a recessed hole, the operation is practically the same. The caliper leg is held against the diameter on four opposite places and the points mark the center. In Fig. 4 the tool is used as an inside and outside measuring caliper and Fig. 5, 6 and 7 it is used as a measuring divider scriber.

Often at the bench and more often at the lathe, the patternmaker finds almost constant use for calipers. Drawings of the outside and inside types of calipers are shown in Fig. 8. Calipers may be likened to the thumb and finger. As noted in describing the compass, the caliper is an ancient tool and is shown on Roman tombs illustrated in Fig. 9.

A great variety of calipers are made such as the type which is adjusted to measurement by tapping, the style which has an adjusting screw fitted to one leg and to a projecting piece connected to the joint and double calipers which combine inside and outside calipers and dividers. Fig. 10 shows the lock joint transfer calipers. This type is useful in calipering over projections such, as flanges. The

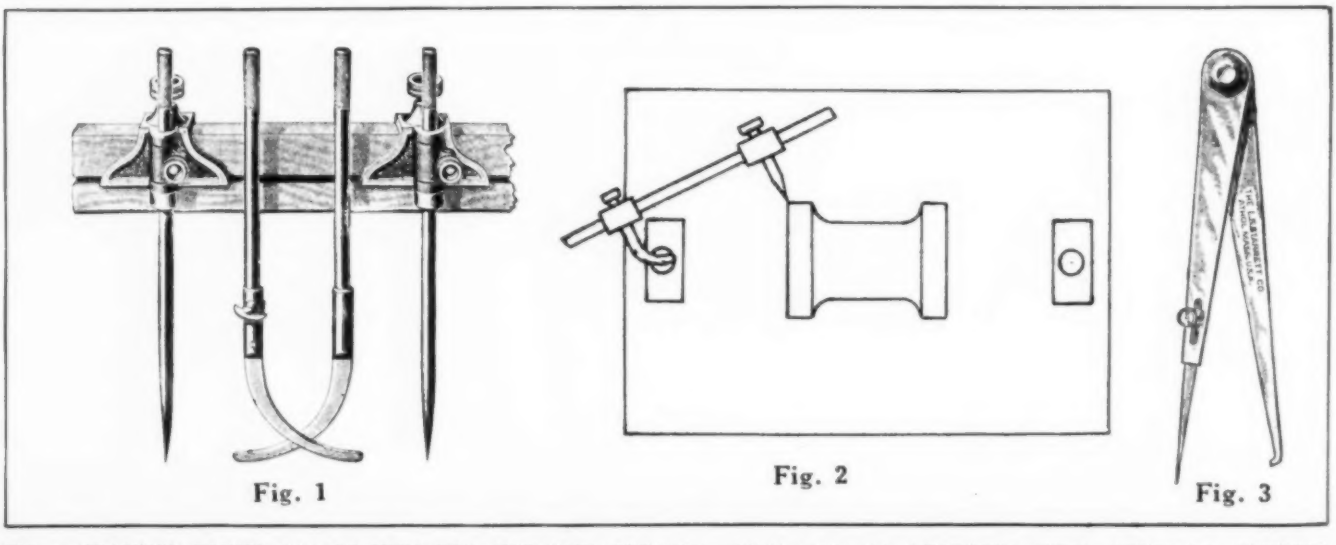
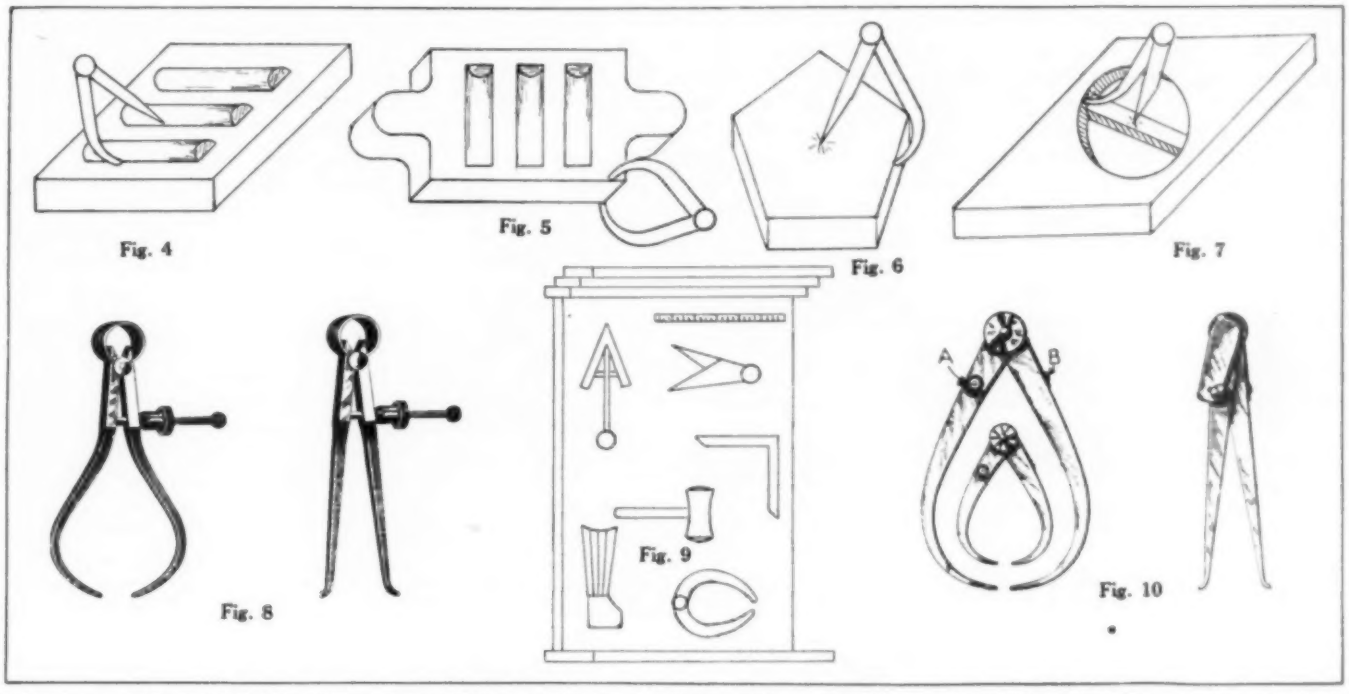


Fig. 1

Fig. 2

Fig. 3

FIG. 1—TRAMMEL POINTS MAY BE USED FOR DISTANCES GREATER THAN MAY BE MEASURED WITH ORDINARY DIVIDERS
FIG. 2—USING A CALIPER LEG. FIG. 3—A SPECIAL TYPE OF CALIPER



FIGS. 4, 5, 6 AND 7—VARIOUS USES OF A SPECIAL TYPE OF CALIPER. FIG. 8—OUTSIDE AND INSIDE CALIPERS. FIG. 9—DRAWN FROM A ROMAN TOMB SHOWING COMPASS, CALIPERS, PLUMB, SQUARE, MALLET AND CHISEL. FIG. 10—LOCK JOINT TRANSFER CALIPERS

inside calipers shown in Fig. 10 may be used for measuring the inside of projections, such as the recess back of a thread chamber. The joint is made so that when it is locked, a small adjustment may be made by turning the nut at *A*. In addition to this, the nut at *B* may be loosened to allow the leg on that side to pivot outward from the point to clear an obstruction, while the joint still remains locked as to the other leg. The leg then may be brought back to the original position. The nut marked *B* tightened.

When the calipers are set with a scale, it is rather difficult to get the exact size although it is known that some mechanics approach a fine degree of accuracy. Ordinarily one man will set the caliper just to the mark, another may include the mark, while still another may try and split the mark. There also will be a variation if two men caliper the outside of a cylindrical piece, as for example the diameter of a print. It is a matter of practice by which accuracy is obtained and one of the things where refinement of feeling or touch may be brought about by training.

Fig. 11 shows the way a scale should be held, when setting the calipers to a mark. The left hand holds the scale with the four fingers underneath and the thumb on top. About one half of the little finger

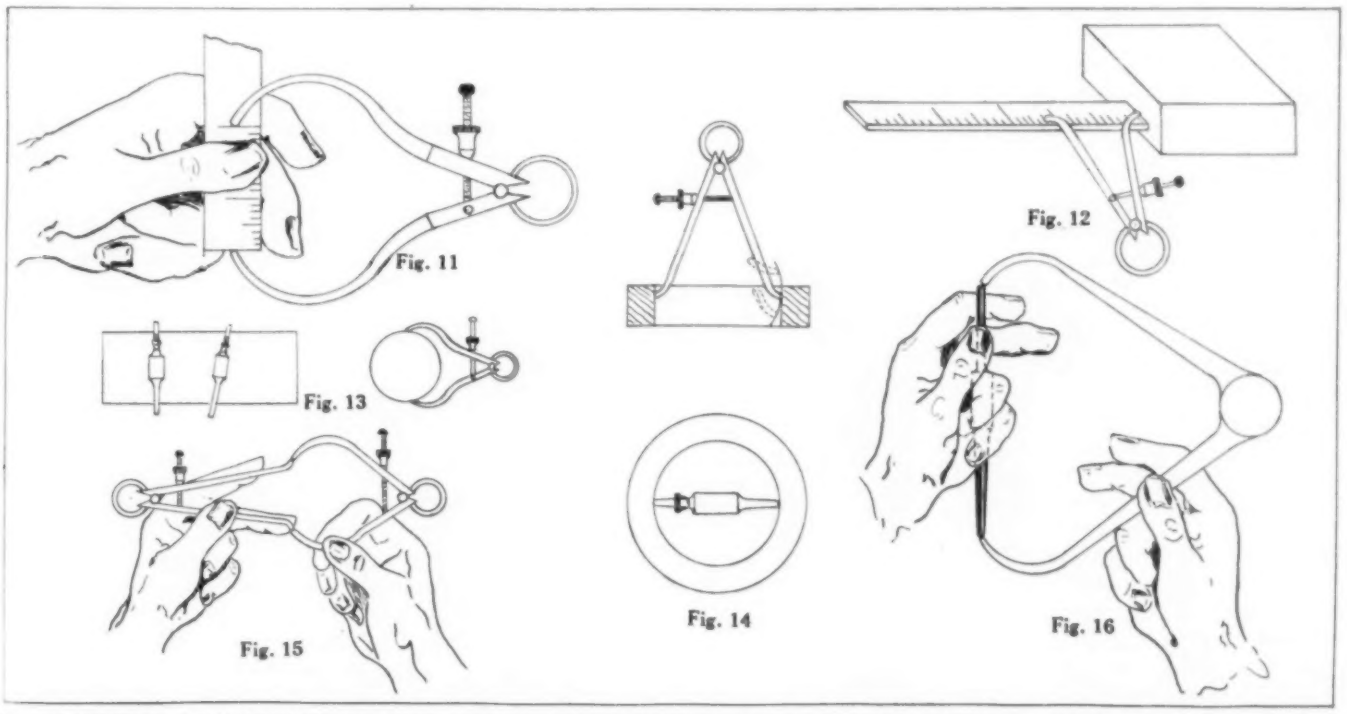


FIG. 11—METHOD OF HOLDING THE SCALE. FIG. 12—ADJUSTING THE SCALE BY HOLDING THE END AGAINST A BLOCK. FIG. 13—RIGHT AND WRONG METHOD OF MEASURING. FIG. 14—ERRORS MAY BE MADE EASILY WITH THE INSIDE CALIPERS FIG. 15—ADJUSTING OUTSIDE CALIPERS TO INSIDE CALIPERS

projects from the end of the scale to supports one leg which is held against the end of the scale, while the fingers of the other hand adjust the other leg by manipulating the nut. The inside calipers are adjusted to the scale by holding the end of the scale against a block as in Fig. 12. There is some spring due to the flexibility of the steel when measuring, especially when large calipers are used, so care must be exercised. One of the easiest methods to follow when measuring with calipers is to hold the calipers above the work and adjusting them so that just the weight of the calipers alone will cause them to pass over the work. This generally will be sufficiently accurate.

When adjusting the calipers to the scale, care must be taken that the points are parallel to the edge of the scale and that the point, should be as nearly as possible to the middle of the line. In using the outside calipers, they must be held square with the axis of the work, otherwise the work may have too much stock turned off. This is shown in Fig. 13.

Owing to more freedom and ease in manipulation, measurements with outside calipers are done more easily than with the inside calipers. The inside calipers must be held true with the axis of the work. If the calipers are not square the hole will be too small when bored. This also may be seen in Fig. 14.

If the outside calipers are adjusted to the inside calipers, they may be held in the hands, as in Fig. 15. The first finger of the left hand steadies the top leg of the inside calipers while the lower leg is steadied with the thumb and middle finger. The first and second finger and thumb of the right hand steadies the outside caliper. The lower legs of both the inside and outside calipers rest against the middle finger of the left hand. By holding these two lower points together, the upper outside leg is moved down to the upper inside caliper leg and is moved backward and forward and sidewise until they have the proper contact. Larger sized calipers may be held as in Fig. 16.

Equipment Manufacturers Meet

ARRANGEMENTS were completed at the spring meeting of the Foundry Equipment Manufarcturers association, held at French Lick, Ind., April 22-23, for the association to be represented with a booth at the annual exhibition of the American Foundrymen's association in Detroit in September. Data regarding the activities of the association will be available at the booth which will be in charge of a special representative of the equipment manufacturers organization.

The attendance at the French Lick meeting was the largest in the history of the association. Nearly every member was represented, and a large group of invited guests also were present. A number of new members were announced, with definite assurances that the growth of the organization will continue throughout the year. The companies now represented in the Foundry Equipment Manufacturers association control a majority of the business.

S. T. Johnston, S. Obermayer Co., Chicago, president of the association, occupied the chair, assisted by Vice President T. W. Pangborn, Pangborn Corp., Hagerstown, Md.

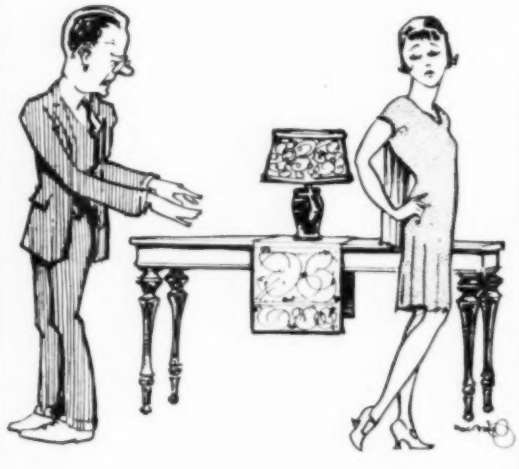
The reports on business conditions indicated a high degree of activity in all departments during the first quarter of the year, averaging about 25 per cent in excess of 1925. Shipments are still heavy. New business continues normal.

G. B. Pickop, the Malleable Iron Fittings Co., Branford, Conn., submitted a report covering recent progress in the development of permanent molds. P. B. Crouse, the Whiting Corp., Harvey, Ill., held the attention of the members for over an hour describing the application of the group bonus plan of wage payment. This method of payment by results, according to Mr. Crouse, avoids the difficulties which frequently are encountered in setting piece rates, resulting in definite increases in production, a more satisfied body of workmen, better direction on the part of the foreman (who also receive bonuses), and a much reduced labor turnover.

"Long Terms on Machinery Sales" were discussed by A. F. Jensen, the Hanna Engineering Works, Chicago. S. C. Vessy, the W. W. Sly Mfg. Co., Cleveland, presented a report on conditional sales. C. E. Hoyt, executive secretary, American Foundrymen's association, described the arrangements for the Detroit exhibition of foundry and shop equipment, which will probably be the largest ever held. The Equipment association pledged its co-operation in the entertainment of the overseas delegates who will attend the Second International Foundrymen's congress, which will be held in Detroit simultaneously with the exhibition.

The next meeting of the Foundry Equipment Manufacturers association will be in Cleveland, June 22.

Faked Foundry Facts



Let 'er Down a Little

Makes Personnel Changes

Rollway Bearing Co., Syracuse, N. Y., manufacturer of heavy duty roller bearings has made the following changes in the personnel of its sales force. C. A. Call, formerly assistant sales manager, Gurney Ball Bearing Co., has been appointed sales manager. E. J. Lybert, formerly representative in the Philadelphia district, has been placed in charge of the Detroit district. J. D. Firmin, formerly with the Niles-Bement-Pond Co., has been appointed engineering representative in the Philadelphia district. W. E. Smith has been transferred to the Youngstown district where he will assist Samuel Farrell, district representative. S. J. Kaiser continues to represent the firm in the Chicago territory.

Brass and bronze goods exported to foreign countries in 1925 show an increase of $6,173,000 or 49.8 per cent, according to the United States chamber of commerce.

THE RANK IS BUT THE GUINEA STAMP

A Man's a Man For A' That

TWENTY-FIVE years ago young Bob Crawford, a duly qualified iron molder, surveyed the field and decided that opportunities for advancement in his native Scotland were limited as compared with those offered in the United States of America. Instead of jumping hastily to a conclusion, he applied the standard test by which molders of all times have decided whether to stay on the job or quit. He threw his shovel in the air with the understanding that if it stayed up he would go to America and if it came down he would go anyway.

Nothing could be fairer.

The shovel came down and as a man of his word Bob had no alternative but to accept the verdict and emigrate. In strict justice perhaps he should have tried two out of three, but an omen is an omen and while Bob is not superstitious he believes in signs—that point his way.

Today Robert G. Crawford is president of the Atlas Foundry Co., Detroit and is interested financially and otherwise in several other enterprises in his adopted city. As president of the Detroit Foundrymen's association he has made advance arrangements for the reception of the foreign visitors to the International Foundrymen's Congress and the convention of the American Foundrymen's association to be held next September.

Inexorable toll of the exceedingly busy years has converted the curling black hair of the young immigrant into a fair imitation of the white plume of Navarre, but it has had no appreciable effect on the buoyant spirit, the restless energy or the boundless enthusiasm of the man who has fought his way upward single handed from a position of obscurity to one where he holds the reins of power in an important manufacturing industry.

From a sentimental viewpoint he yields to no man in a love for the land of his birth. A picture of Robert Burns ornamented with a faded sprig of heather hangs on a wall in his office, but that does not detract in any measure from his allegiance to the land of his adoption. His mother was deeply scandalized when Bob wrote home that he had become a naturalized American citizen and had renounced all allegiance to any foreign power, prince or potentate, particularly King George V of Great Britain and Ireland.

The embryo citizen of this great republic regretted the necessity of causing even a momentary pang in the maternal breast, but he could not reconcile his logical Scottish mind to earning a living in one country while retaining citizenship in another.

"I hae naething pairsonal, ye ken" he admits "Against King George or cny o' his family, but we never were on what ye might ca' rael veesitin' terms an' I hae ma doots forbye that he ever has missed me."

Here he has lived the most important years of his life, here he has built up a wide circle of friends and acquaintances, here his children have grown up and here he intends to be laid away when the final roll call summons him from the scene of his earthly labors.

Before locating in Detroit in 1908 he worked as a journeyman molder in several prominent American foundries where he rapidly assimilated the hustling spirit pervading the industry on this side of the Atlantic. In 1908 he secured his first foreman's position with the Detroit Foundry Co., but left there shortly afterward to assume a similar position with the Murphy Iron Works. He still carries a handsomely engraved watch presented him when he left this position to become foundry foreman of the newly organized Atlas Foundry in 1910.

Failure of the United States Motor Co. in 1913 involved the Atlas Foundry in financial difficulties, but Bob stuck to the ship and in recognition of his efforts in preventing a wreck he was appointed secretary and manager of the company. The

(*Concluded on page* 412)

The Shakeout

DAN M. AVEY, Editor
PAT DWYER, Engineering Editor
CHARLES VICKERS, Nonferrous Editor
FRANK G. STEINEBACH, Associate Editor

¶ As Others See Us

BUSINESS integrity, that honesty which extends down into the pocket book and impels one to pay his just debts always has been held up as the sterling mark of character. This trait has been set forth to many generations as the highest ideal to be attained in commercial life and has been expressed into that simile of high tribute, "his word is as good as his bond." Contact with hundreds of manufacturers and producers of materials and equipment used in foundries has brought forth many expressions of admiration for the standard of business integrity which obtains among foundrymen. An official of a large eastern supply house with over thirty years experience, selling to foundries, stated that in all that time losses from bad debts had been less than a half of one per cent.

RECENTLY an entirely unsolicited letter reached THE FOUNDRY office in which the following statement appears:

> *. . . I have had the opportunity to get acquainted with the business integrity of the foundrymen of this United States and Canada. Out of every thousand customers having charge accounts with us, I can truthfully state that only one out of the thousand is over thirty days in our debt. This covers a period of nearly four years. I know every foundryman will be pleased and proud to know that they rate* 100 *per cent in integrity. I consider the fact wonderful and worth while mentioning. . .*

It is rather fine to be a part of a group of which this can be said.

¶ Warm Welcome Assured

ALTHOUGH the convention of the American Foundrymen's association and the second International Foundrymen's Congress still is five months away, active preparations are going forward to receive the visitors from overseas. In the half dozen cities on the itinerary of the foreign party, arrangements are being made to extend the courtesies of plant visitations to representative foundries. Practically without exception, American manufacturers anticipate this act of hospitality as a privilege and a pleasure. Those who went to Europe three years ago have not forgotten the cordiality of their reception or the manner in which foreign foundrymen presented them with the figurative keys of their various cities.

¶ Vanishing Saturation Point

FOR several years financial experts and business prognostigators have been viewing with alarm and pointing the well known finger of caution at the steadily rising tide of automobile production in this country. They have shaken their heads wisely and claimed that this production could not be absorbed. Each year they have seen the saturation point looming omniously on the horizon. They have quoted voluminous statistics and presented charts of business cycles in support of their claim that there is a limit to all buying movements. They even have invoked the law of gravity to prove that whatever goes up inevitably must come down.

No statistics are available to show how many people have taken these warnings seriously, but apparently they have fallen upon the deaf ears of at least two classes of the community. One is the class embracing all those engaged directly or indirectly in the manufacture, sale and distribution of automobiles. The second class includes all those who either own or have made up their minds to buy automobiles. Since these two classes represent practically the entire earning and spending part of the population the conclusion seems obvious that the saturation point is still some distance in the installment future.

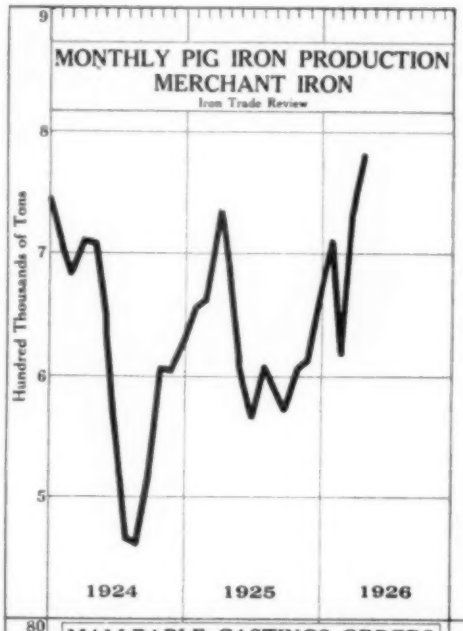
IN THE meantime every automobile factory is increasing its production schedule. Many plants are working day and night and practically every one has installed, is installing or contemplating the installation of new equipment to reduce operating costs and to give an increasingly greater number of people what they want. Apparently the saturation point is the least of their worries.

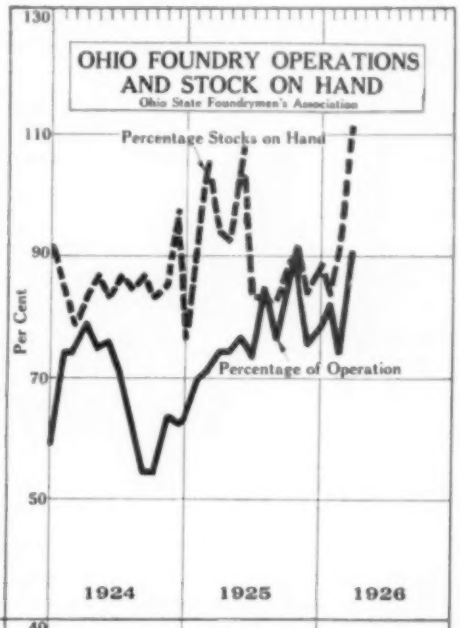
Trade Trends in Tabloid

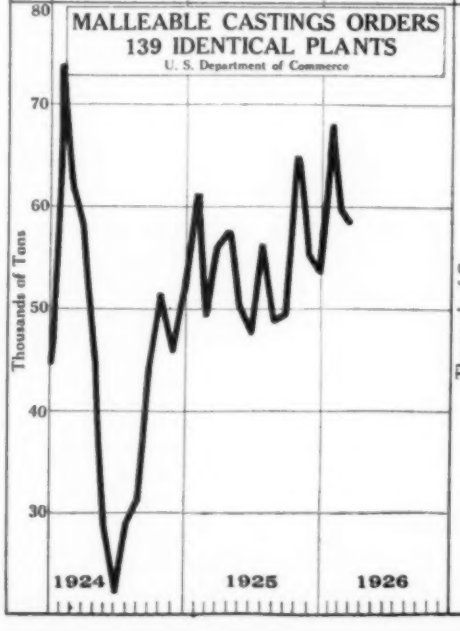
RAILWAY equipment buying, expected to fill the gap which many believe will develop due to decreased automobile sales, has failed to make its appearance. The total of railway car orders for April declined to 4615 and new inquiries have not materialized in sufficient volume to indicate early heavy buying. The totals on automobile production for April are not available, but individual reports from a number of the larger manufacturers indicate that a decided recession will be shown for the past month. Production of agricultural implements continues at a high rate, the output for the first quarter ranking about 30 per cent ahead of last year. Building construction outside of the main centers is going ahead, but in the larger cities labor disputes have hampered the start of many projects. The total output of pig iron showed a gain of 3.05 per cent, according to the *Iron Trade Review*, while merchant iron production in April was about 7 per cent ahead of the preceding month. Average prices of nonferrous metal during April, according to the *Daily Metal Trade*, are as follows: Casting copper, 13.40c; electrolytic copper, 13.962c; Straits tin, 63.432c; lead, 8.02c; aluminum, 27.00c and zinc, 7.012c. Slight decreases have been noted in the demand for plumbing goods, due to interruptions to building operations in some of the larger centers previously mentioned.

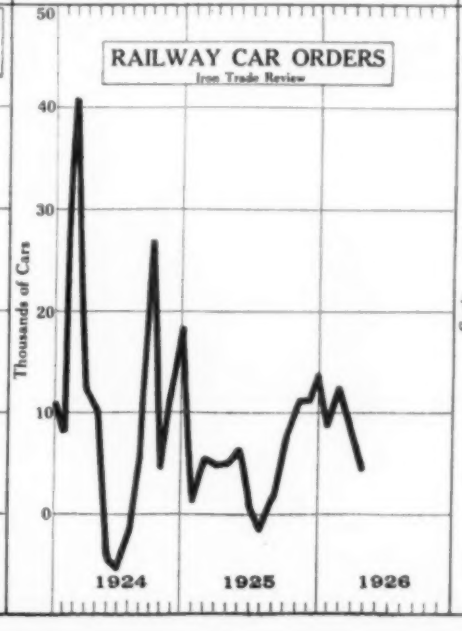
RAW MATERIAL PRICES
MAY 7, 1926

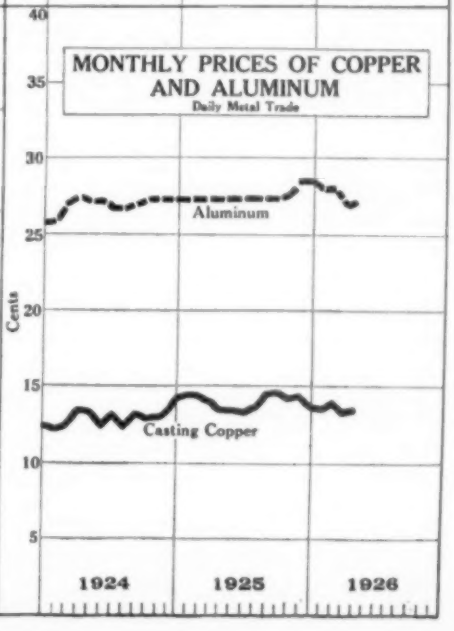
Iron	
No. 2 foundry, Valley	$19.00
No. 2 southern Birmingham	21.00 to 22.00
No. 2 foundry, Chicago	22.00
No. 2 foundry, Philadelphia	22.76
No. 2 foundry, Buffalo	21.00
Basic, Valley	18.50
Basic, Buffalo	20.00 to 20.50
Malleable, Chicago	22.00
Malleable, Buffalo	21.00
Coke	
Connellsville foundry, coke	$4.00 to 4.50
Wise County foundry, coke	4.25 to 5.50
Scrap	
Heavy melting steel, Valley	$16.00 to 16.50
Heavy melting steel, Pitts	16.00
Heavy melting steel, Chicago	12.50 to 12.75
Stove plate, Chicago	15.00 to 15.50
No. 1 cast, New York	14.50 to 15.00
No. 1 cast, Chicago	18.25 to 18.75
No. 1 cast, Philadelphia	18.00 to 18.50
No. 1 cast, Pittsburgh	16.50 to 17.00
No. 1 cast, Birmingham	17.00 to 17.50
No. 1 cast, Buffalo	15.00 to 15.50
Car wheels, iron, Pittsburgh	17.00 to 17.50
Car wheels, iron, Chicago	15.75 to 16.25
Railroad malleable, Chicago	16.50 to 17.00
Agricultural, mall., Chicago	15.00 to 15.50
Malleable, Buffalo	21.00 to 22.00
Railroad Malleable Pitts	17.50 to 18.00
Nonferrous Metals	Cents per pound
Casting copper, refinery	13.40
Electro copper, producers	13.87½
Straits tin	64.75
Lead, New York	7.85
Antimony, New York	12.25 to 12.50
Nickel, electro	39.00
Aluminum, No. 12, prod'rs	26.50
Aluminum, No. 12, remelt	24.00 to 24.50
Zinc, E. St. Louis, Ill.	6.75











Comings and Goings of Foundrymen

WILLIAM BLUM whose election as president of the American Electrochemical society was announced at the meeting held in Chicago April 22 to 24, has been engaged continuously in scientific pursuits since he was graduated from the University of Pennsylvania, Philadelphia in 1903. He taught in the University of Utah from that date until 1909 when he became connected with the bureau of standards. At present he is chief of the electrochemistry section of that important government agency.

William H. Woodin, American Car & Foundry Co., New York, was elected a member of the council of the Pennsylvania Society of New York.

James Arterburn, formerly superintendent, Evinrude Motor Co., Milwaukee, is now general foundry superintendent, Gilson Mfg. Co., Port Washington, Wis.

B. W. Lattin, formerly with the D. J. Ryan Foundry Co., Ecorse, Mich., and the Ferro Enameling Co., Cleveland, now is with Moore Bros. Co., Joliet, Ill.

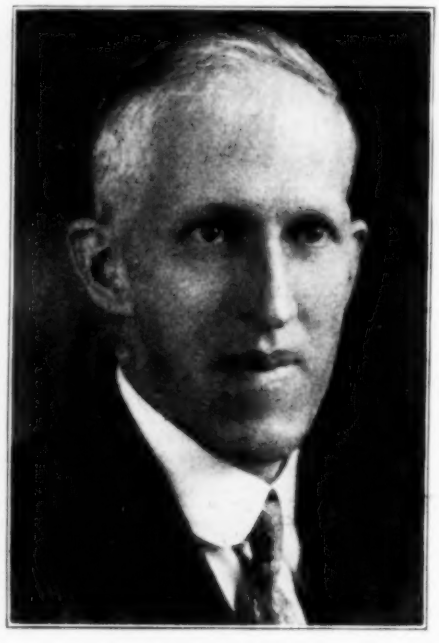
John Fogarty, one of the organizers of the Keystone Foundry Co., Plymouth, Ind., has leased that firm's plant and will resume operations. The shop has been idle some months.

Clyde N. Thomas, formerly with the Beach Foundry Co., Ltd., Ottawa, Ont., and previously with the Ferro Enameling Co., Cleveland, now is with the Stanley Insulating Co. Inc., Great Barrington, Mass.

D. B. Stokes has been elected vice president in charge of sales of the United States Cast Iron Pipe & Foundry Co., Burlington, N. J. He has been with the company for many years.

J. E. Fletcher, British Cast Iron Research association, who delivered the British exchange paper at the Syracuse convention last October, and who was taken seriously ill some time after his return to England, now is recovered.

William H. Walther, formerly superintendent of the Bradley & Hubbard Co., Meriden, Conn., has resigned, to enter the foundry business in Hartford, Conn., with Edgar B. Spencer. The foundry now is being equipped and will manufacture gray iron castings.



DR. WILLIAM BLUM

Carl Lando, formerly superintendent of the Milwaukee plant of the International Harvester Co., and more recently with the Nash Motors Co., Kenosha, Wis., has returned to the Harvester company. He will take charge of the gray iron foundry of the former Moline Plow Co. at Rock Island, Ill., which the Harvester company is putting back into production.

A. W. Gregg, recently made general superintendent of Bucyrus Co., South Milwaukee, Wis., manufacturer of excavating equipment, formerly was foundry superintendent. He was graduated from Purdue university, Lafayette, Ind., in 1904 and the next year joined the Bucyrus company. He was foundry superintendent for the Whiting Corp., Harvey, Ill., for a time, returning to Bucyrus in the same capacity. N. R. Knox, assistant foundry superintendent succeeds Mr. Gregg as foundry superintendent.

JAMES ARTERBURN

J. T. Hickman, formerly foundry superintendent of the Michigan Lubricator Co., Detroit, is now foundry superintendent of the Roberts Brass Mfg. Co., Detroit. Mr. Hickman was apprenticed to a foundry in Birmingham, England at the age of 13 years, and finished his indenture when he was 18. He also attended the night classes at the Birmingham Technical school for four years. While in England, Mr. Hickman was connected with John Bolding & Son's London, in its West Bromwick, Staffordshire branch, and also with John Wright & Eagle Range, Birmingham. He came to the United States in 1910 and has been connected with the Ludlow Mfg. Co., Troy, N. Y.; J. B. Wise & Co., Watertown, N. Y.; Edgar Electric Co.; and has been foundry superintendent of the Michigan Lubricator Co., for the past three years.

To Meet In Belgium

Institute of Metals, London, will hold its annual fall meeting at Liege, Belgium from Sept. 1 to 4 through the invitation of the Association des Ingenieurs Sortis de l'Ecole de Liege. This is the first meeting held on the Continent since the Ghent meeting in 1913.

Will Hold June Meeting

New England Foundrymen's association will hold its June meeting at the Exchange club, Boston, June 9. The program includes papers on plaster patternmaking, statuary patterns and large patterns.

G. Clifton Deeter has resigned his position as alloy specialist with the American Boron Products Co., Reading, Pa., to become associated with the D. & E. Metals Co., York, Pa. Mr. Deeter is secretary-treasurer of the latter firm which recently was organized.

Pipe Executive Dies

Louis R. Lemoine, chairman of the United States Cast Iron Pipe & Foundry Co., Burlington, N. J., died recently at the home of his daughter at Villa Nova, Pa., of pneumonia.

Born in St. Louis in 1859 Mr. Lemoine went to Philadelphia in 1883 and became associated with R. D. Wood & Co., cast iron pipe manufacturers. In 1896 he became vice president of the McNeal Pipe & Foundry Co., holding that office until the company was absorbed by the United States organization. He later became resident and subsequently general manager of the New Jersey Zinc Co., with offices in New York. In 1910 he returned to the United States company as second vice president in charge of sales, becoming president in 1911. He served in that capacity until 1923, when he was elected chairman having his offices at Philadelphia. Mr. Lemoine for years was recognized as one of the ablest men in the cast iron pipe industry of this country and one of his outstanding achievements was the building up of the manufacture of centrifugal pipe on a commercial basis. He was active in the work of all departments of his company and one of his dominant characteristics was the interest which he took in promising young men who developed in his organization. In fact, the company now is officered and managed throughout by young men who received their training under Mr. Lemoine and thus won his recognition. He was a member of the American Iron and Steel institute.

To Hold Convention

Institute of British Foundrymen will hold its annual convention at Agricultural hall, London, from June 16 to 19. The convention will be opened by the Right Honorable Arthur Henderson who formerly was a practical foundryman, and now is a member of the King's Privy council. During the convention the following papers will be submitted and dis-

"Quantity Production with Quality of Product," Arnold Lenz, Saginaw Products Co., Saginaw, Mich.; "Foundry Sands," M. Lemoines, Paris Foundry high school, Paris, France; "A Comparison of Some Results Obtained when Improving the Tensile Qualities of Cast Iron,"' L. Piedboeuf, Belgium; "Chemical Reactions in the Cupola, with Special Reference to Fuel Consumption," Prof. F. C. Thompson and M. L. Becker, Manchester university, Manchester; "Some Notes on the Rate of Cooling of Cast Iron," J. E. Hurst, Centrifugal Castings Co., Kilmarnock, Scotland; "Some Notes on the Production of Cylinder Pig Iron to Fracture and Analysis," E. J. Yates, Goldendale Ironworks, Tunstall, North Staffordshire; "Nonferrous Metallography," J. S. G. Primrose, Bradford Iron Works, Bradford, Manchester; "Cast Iron for Electrical Machines," J. H. Partridge, research department, University of Birmingham, Birmingham.

The paper by Mr. Lenz is the

LOUIS R. LEMOINE

American exchange paper, that of M. Lemoines is the French exchange paper and that of L. Piedboeuf is the Belgian exchange paper. The annual banquet will be held June 16, Sir Alfred Mond presiding.

Charles H. Clark recently has been appointed raw material salesman for the Bridgeport Brass Co., Bridgeport, Conn.

To Elect Officers

Detroit Foundrymen's association will hold its annual meeting and election of officers on May 20 at the Detroit Union League club rooms. An elaborate program has been arranged by the entertainment committee with Judge Frank Murphy as the speaker. J. W. Smith, mayor of the city, will be present.

To Build at Houston

Tentative plans for the new plant of the Oklahoma Steel Castings Co., Tulsa, Okla., at Houston, Tex., provide for a foundry, pattern shop and pattern storage building of mill type, steel and concrete construction. The plant will occupy a 10-acre site recently purchased and construction will begin immediately. The initial capacity of the new plant is expected to be 300 tons a month.

Obituary

Elmer M. Love, manufacturer and life-long resident of Corry, Pa., died recently following an illness of several months. Mr. Love operated the Love Mfg. Co., gray iron and brass founders, and also was the head of E. M. Love & Son, road builders.

Foundry Association Directory

The Buffalo Foundrymen
Buffalo

President, J. McARTHUR, Washington Iron Works; secretary, W. J. WARK, E. J. Woodison Co., 146 Chandler street. Meetings the third Wednesday of the month at 146 Chandler street.

Chicago Foundrymen's Club
Chicago

President, CHARLES L. LARSEN, Armour Institute of Technology 3200 Federal street, Chicago; secretary-treasurer, E. C. BARRINGER, THE FOUNDRY, 1147 Peoples Gas building, Chicago. Meetings second Saturday in each month at the City Club, 315 Plymouth court.

Detroit Foundrymen's Association
Detroit

President, ROBERT G. CRAWFORD, Atlas Foundry Co., 131 South Artillery street, Detroit; secretary, RUSSELL M. SCOTT, Packard Motor Co., 1580 East Grand boulevard, Detroit. Meetings third Thursday in each month at the Union League club, 35 Grand River avenue, Detroit.

Metropolitan Brass Foundry Association
New York

President, THOMAS HARPER, Thomas Harper, 204 Lafayette street, New York; secretary, WM. E. PAULSON, Thomas Paulson & Son Inc., 97 Second avenue, Brooklyn, N. Y. Meetings second Wednesday in each month at the Building Trades club, 34 West Thirty-third street, New York.

Newark Foundrymen's Association
Newark, N. J.

President, J. L. CARTER, Barlow Foundry, Inc., Newark; secretary, W. H. MANTZ, Atlas Foundry Co., Irvington, N. J. Meetings called by president.

New England Foundrymen's Association

President, H. P. BLUMENAUER, Arcade Malleable Iron Co., Worcester, Mass.; Secretary, FRED F. STOCKWELL, 205 Broadway, Cambridgeport, Mass. Meetings second Wednesday of each month at the Exchange club, Boston. Outings usually are held in the summer months.

Ohio State Foundrymen's Association

President, WALTER L. SEELBACH, Walworth Run Foundry Co., 2488 West Twenty-seventh street, Cleveland; secretary-manager, ARTHUR J. TUSCANY, 5713 Euclid avenue, Cleveland.

Philadelphia Foundrymen's Association
Philadelphia

President, CHARLES R. SPARE, Janney Cylinder Co., Holmesburg, Philadelphia; secretary, HOWARD EVANS, J. W. Paxson Co., Luzerne and D street, Philadelphia. Meetings the second Wednesday of each month at the Manufacturers' club.

Pittsburgh Foundrymen's Association
Pittsburgh

President, WILLIAM K. FRANK, Damascus Bronze Co., South avenue, N. S. Pittsburgh; secretary-treasurer, WM. J. BRANDT, Wm. J. Brandt, Bessemer building, Pittsburgh. Meetings on the third Monday of the month, except in July and August, at Fort Pitt hotel.

Quad-City Foundrymen's Association
East Moline, Ill.

President, J. H. DIEDRICH, Blackhawk Foundry & Machine Co., Davenport, Iowa; secretary-treasurer, A. D. ZIEBARTH, Davenport Foundry & Machine Co., Davenport, Iowa. Meetings the third Monday evening of each month, the meeting place being rotated between Moline, Rock Island and Davenport.

Southern Metal Trades Association
Atlanta, Ga.

President, W. C. TROUT, Lufkin, Tex.; secretary-treasurer, W. E. DUNN JR., Healey building, Atlanta, Ga. The 1926 convention to be held at Macon, Ga., the date to be announced later.

Tri-City Technical Council
Moline, Ill.

Chairman, H. BORNSTEIN, Deere & Co., Moline, Ill.; treasurer, MAX SKLOVSKY, Deere & Co., Moline, Ill. Combined meetings held only one or two times a year on call.

Twin City Foundrymen's Association
Minneapolis-St. Paul

President, J. A. TEACH, Minneapolis Steel & Machinery Co., Minneapolis; secretary-treasurer, C. E. LANGDON, 3849 Lyndale avenue, So., Minneapolis. Meetings monthly at the Athletic club.

The Rank Is But the Guinea Stamp

(*Concluded from Page* 407)

following year he was appointed president and general manager and since no further offices were available he still is president and general manager.

A few years ago when his fellow townsman Henry Ford absorbed the Lincoln Motor Co., the paternal U. S. government put in a claim for over $9,000,000 for back taxes or some other perfectly trivial cause of that kind. If this claim were paid the other creditors including the Atlas Foundry stood a fat chance of getting nothing. Bob has no objection to spending a dollar or in giving away a dollar, but he is a first class concientious objector when any person attempts to do him out of a dollar that is rightfully his. He slipped down to Washington and put up such a masterly presentation of his case before the department of justice that all the Lincoln creditors had their claims paid in full.

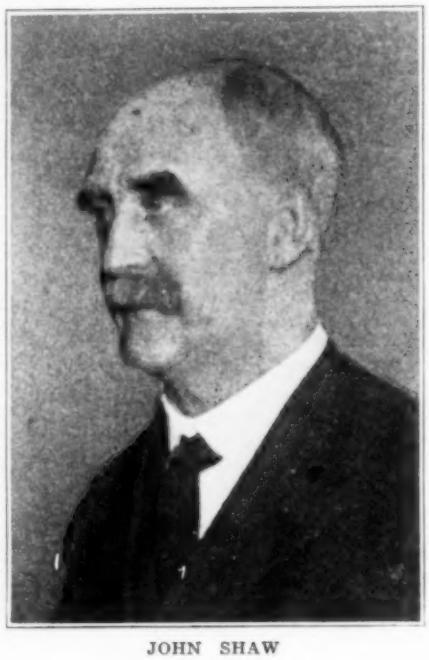
Many prominent foundry executives in Detroit and elsewhere received their training under Mr. Crawford. His attitude toward his employes is illustrated in a typical incident. He fired one of his molders one night for drinking on duty. The following morning he found the man busily at work. "Hey!" said he. "Did I no' fire ye last night?" "Arragh go 'way with ye," said the lad with a wheedling grin. "Ye won't need to do it again. If you don't know when ye have a good man, I know when I have a good boss!"

John Shaw To Present British Exchange Paper

John Shaw who is to present the Institute of British Foundrymen's 1926 exchange paper at the Detroit meeting of the American Foundrymen's association, has been associated prominently with the British foundry industry all his life.

He was educated at the Farnworth grammar school, Widnes technical school, and Liverpool university. After completing his education, Mr. Shaw served his time as apprentice with the Widnes Foundry Co., and owing to his ability was made assistant foreman at the age of 19. He was in full charge of a foundry at 22. After six years in charge of a small foundry in Wales he became foundry manager for Cochrane & Co., Ltd., Dudley. During the war Mr. Shaw was director of the gray iron castings section of the British ministry of munitions. For the past several years he has been manager of the Newhall works of the Brightside Foundry & Engineering Co., Ltd., Sheffield.

Mr. Shaw has been identified prominently with foundry organization affairs for many years. He joined the Institute of British Foundrymen in



JOHN SHAW

1906. He was president of the Birmingham branch for three years and is now president of the Sheffield branch. He is the third oldest British member of the American Foundrymen's association, which he joined in 1910. Mr. Shaw represents the Institute of British Foundrymen on the international committee appointed to work out standardized tests for cast iron. He is also the delegate of the institute to the British Engineering Standards association.

As a fitting tribute for his distinctive and valuable services to the foundry industry of Great Britain Mr. Shaw was presented with the Oliver Stubbs gold medal at the 1924 meeting of the Institute of British Foundrymen.

The subject of Mr. Shaw's paper will deal with cast iron problems of a metallurgical nature.

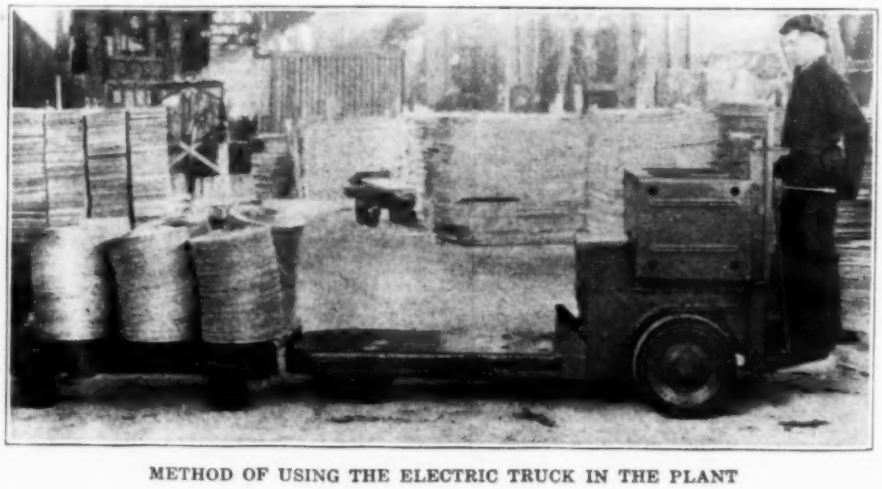
Electric Truck Includes Lifting Features

The Yale & Towne Mfg. Co., Stamford, Conn., recently has developed a new elevating platform truck of the heavy duty type. The short turning radius and the narrow width of the machine makes it easy to drive in and out of the box cars or in narrow aisles. The elevating platform is raised by two large eccentrics mounted on the hoist unit shaft. The eccentrics draw the platform forward and upward on the platform links. Mechanical upper and lower limit stops give simple operation of the lift mechanism. The spur-geared unit power axle on this model is interchangeable with all other models of the same series made by that company. The universal joints of the unit are totally enclosed in leather boots packed with grease. A view of the truck showing the method of operation is given in the accompanying illustration.

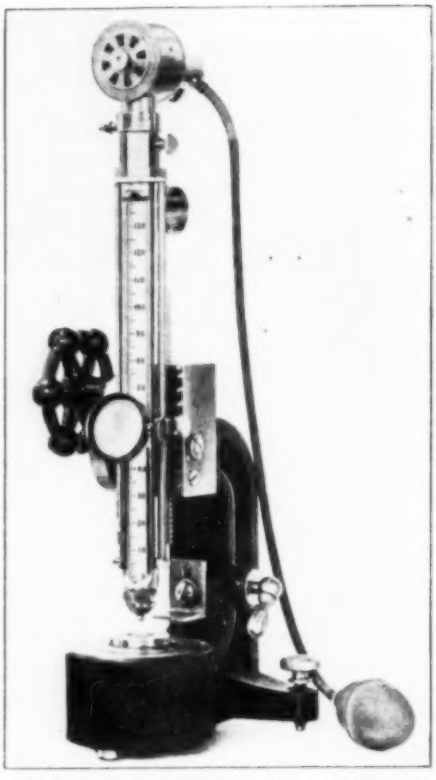
Issue Circular on Gases

Bureau of standards circular No. 279 recently published, discusses the relation between the temperatures, pressures, and densities of gases. Formulas expressing these relations are derived as simply as possible and by the use of factors taken from curves drawn from experimental data, the calculations of the various relations are expedited considerably.

Interstate Foundry Specialties Corp., New York, has removed its offices to 461 Fourth avenue.



METHOD OF USING THE ELECTRIC TRUCK IN THE PLANT



CHANGES ARE MADE ON THE HARDNESS TESTING MACHINE

Tests Metal Hardness

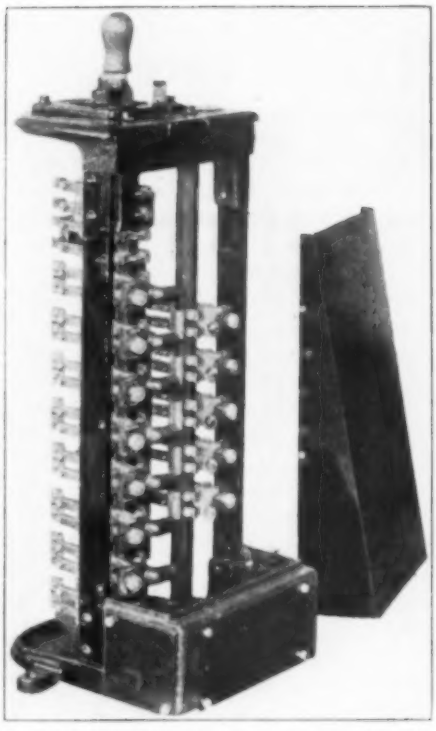
The Shore Instrument & Mfg. Co., Van Wyck & Carll streets, Jamaica, N. Y., recently has made a number of improvements on the hardness testing machine of its manufacture. As may be seen in the accompanying illustration, the auxiliary flat clamping foot piece used previously has been replaced by a graduated barrel unit. This unit is reinforced so that by using a comparatively heavy, hardened-steel, bottom cap, the test specimen may be clamped directly under it. The necessary lightness in weight, which is essential when using the instrument on a swing arm, has been retained in this design. It is claimed that not only is the spot to be tested located more easily and pressure applied in closer proximity to it, but the contact with the supporting anvil also is more concentric, thus giving a degree of uniformity and accuracy to the readings under adverse conditions.

Sand Throwing Machine Has Long Arm

The Allis-Chalmers Mfg. Co., Milwaukee, is using a sand throwing type molding machine which is distinguished by its exceptionally long arm. While the average arm is 12 feet in length on this type of machine, the arm used at the Milwaukee plant is 27 feet in length. This unusual length is of especial assistance in ramming pits. The sand throwing machine, which was built by the Beardsley & Piper Co., Chicago, is of the locomotive type and is the second installed by the Allis-Chalmers Co. The machine, which is shown in the accompanying illustration, handles 30 tons of sand per hour and is operated by two men.

Builds Drum Controller

The General Electric Co., Schenectady, N. Y., has introduced a new and standardized line of drum controllers for general purposes, crane hoist or machine tool application. One of the features of this line is the use of skeleton type frame. The frame consists of a cast cap plate and base to which steel bars are riveted. This feature makes it unnecessary for the back of the controller to hold the top and bottom together. This makes the switch accessible from both the back and front for the purpose of making adjustments, renewals, etc.

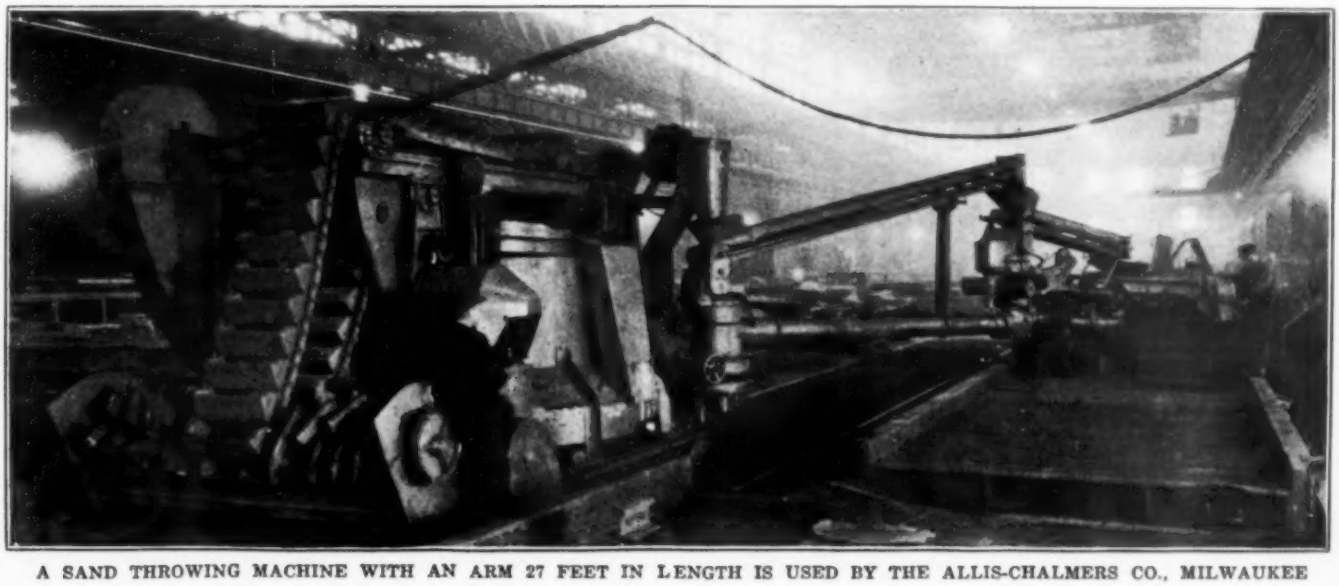


THE SKELETON FRAME IS A FEATURE OF THE DESIGN

A vertical operating lever or a spring return mechanism may be substituted easily for the horizontal lever with which the controller is equipped. Self-aligning contact fingers are used and auxiliary contact fingers are provided for control circuits to the line protective switch.

Changes Office Location

Ohio Brass Co., Mansfield, O., has removed its Chicago office from 1217 to 1714 Fisher building, 343 South Dearborn street.



A SAND THROWING MACHINE WITH AN ARM 27 FEET IN LENGTH IS USED BY THE ALLIS-CHALMERS CO., MILWAUKEE

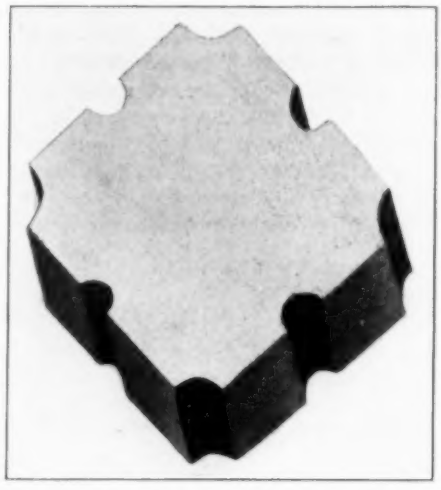
Hoist Operates With Low Headroom

The Northern Engineering Works, Detroit, recently has introduced an electric hoist designed for use where limited clearance and a high lift are necessary. The hoists will be built in sizes from 1 to 4 tons inclusive with a standard hook lift of 20 feet. The frame is made of a one-piece casting while the gears and pinions are hammered steel, case hardened, entirely enclosed and run in a lubricant. Roller bearings are used throughout. Any standard make motor can be applied to the hoist. Either a single or variable speed controller may be used. The hoist is supplied with a mechanical brake in the hoisting gear train and a shoe type pincher brake on the motor. The drum and sheaves are of large diameter, machine finished and drum grooved. Upper and lower limit stops are provided. The hoist may be supplied with geared or plain I-beam trolley or without a trolley for stationary mounting. Two upper suspension hooks are furnished for stationary mounting. A view of the hoist is shown in the accompanying illustration.

Sand Cutting Machine Has Five Motors

A sand cutting machine which includes a number of interesting features of design, recently has been introduced by Production Equipment Co., 5213 Windsor avenue, Cleveland. A feature of this machine is the use of five motors for various drives. One motor drives the cylinder, one the cable reel, one the hoist and one each for the two driving wheels. It is claimed that this provides considerable flexibility. The cutting cylinder consists of special spiral blades constructed of steel members. A hoist is provided to change the position of the cylinder when desired. Either hand or motor operated hoists may be supplied. The electric hoist unit consists of a standard hoist motor coupled direct to the drum on which the hoist cable is wound. Raising and lowering is accomplished by reversing the motor through a reversing switch conveniently located. A counter balance is used on the hand operated hoists to reduce the effort required to raise the cylinder.

The machine is moved by two large motors, one to each wheel. While the wheels are operated by independent motors the motors are interlocked electrically. The steering and speed of travel is handled through a controller by two operating levers. Machines are equipped with single, two or multispeed travel motors, depending on the requirements. Electric power reaches the motors through a flexible cable, collector rings and a brush. The cable is wound on a motor driven cable reel designed to maintain a sufficient tension on the cable to keep it off the floor.



THE POLISHER IS RUBBED UP AND DOWN ON THE PIN

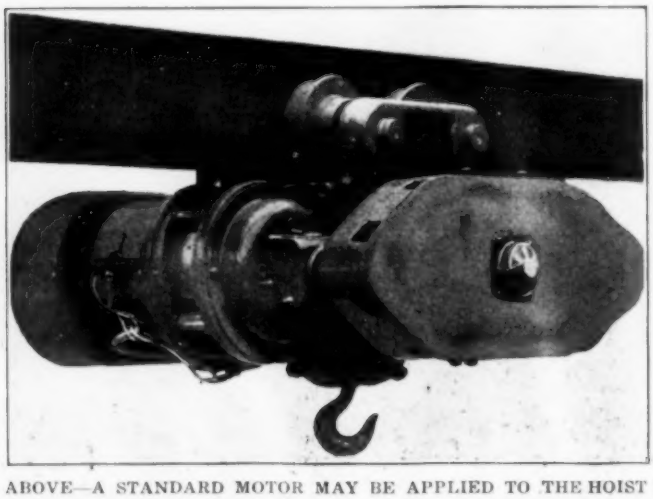
Polishes Flask Pins

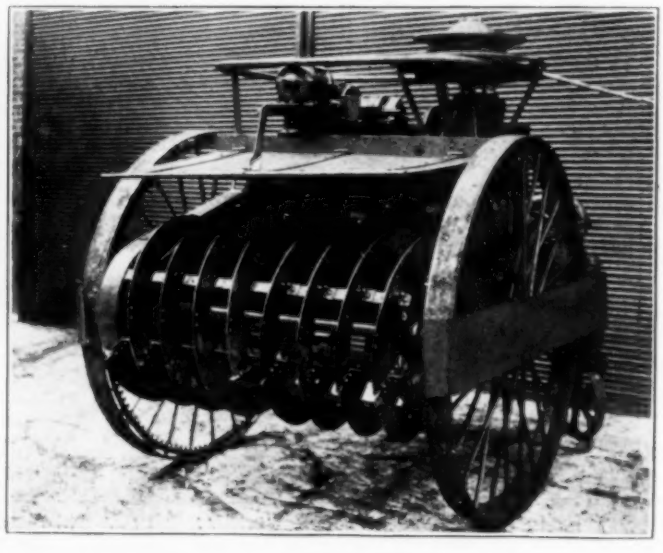
Often the pins on flasks which are not in continuous use become rusted, and difficulty is encountered in using the flask since the pin will not go into the socket. The Joseph Dixon Crucible Co., Jersey City, N. J., recently has introduced a device for polishing flask pins. This device, which is shown in the accompanying illustration, is made from a mixture which contains sufficient grit to cut the rust and enough graphite to polish the pin so that it will slip into place readily.

Designs Soldering Iron

The General Electric Co., Schenectady, N. Y., is marketing a new soldering iron of light construction, designed to heat quickly. This iron is made in standard sizes ranging from ½ to 1¼-inch tip. Power consumption ranges from 70 watts for the smaller iron for light intermittent use, to 350 watts for the larger size for heavy duty. Heavy duty irons have radiating stands to maintain the correct operating temperature when not in use temporarily. Heat from the tip is prevented from reaching the handle by a special mechanical connection in the form of a spiral made from a steel rod. A powder is used for insulating the heating unit. This powder is highly compressed and is designed to withstand a temperature of more than 2000 degrees Fahr.

Iron and steel scrap imports increased from 149,724,000 pounds in 1924 to 223,586,000 pounds in 1925 or 49.3 per cent.





ABOVE—A STANDARD MOTOR MAY BE APPLIED TO THE HOIST
RIGHT—THE CYLINDER HAS TWO OPPOSED SPIRAL BLADES

Anticipate Increasing Demand

Heavier Inquiries Point To Greater Sales in the Near Future—Association Report Shows March Sales Have Gained Slightly

THE demand for foundry equipment throughout the country is spotty, while inquiries are being introduced in practically the same volume. In direct contrast with the beginning of April, the early part of May has shown a good volume in the Chicago district. The International Harvester Co., Chicago is a big factor in the market, since it will reopen about July 1 the foundry formerly operated by the Moline Plow Co., Rock Island, Ill. The Harvester company is buying much new equipment. Makers of equipment in that section believe that buying in May will exceed that in April.

In the Cleveland territory, with only a few exceptions, manufacturers are securing a volume of business comparable with either March and April. Inquiries are appearing in large numbers, and prospects appear bright. Slight improvement has developed in equipment sales throughout New England recently. The demand in the Eastern market continues relatively slack. In some lines, such as sand handling equipment and molding machines, trading appears unusually light for this season of the year. However, melting units appear to be moving more freely, and this, it is believed, likely will be reflected in increased buying of some of the products moving more slowly.

Better conditions prevail in the Pittsburgh market as buying has been active and inquiries are exceptionally heavy. The Bethlehem Steel Corp., Bethlehem, Pa., wants two 108-inch cupolas, the largest cupolas asked for since the Philadelphia navy yard installation was made. Foundries at York and Tarentum, Pa., the Iron City Sanitary Mfg. Co., Zelienople, Pa., and the Howard Stove Co., Beaver Falls, Pa., each want core ovens.

Sales of foundry equipment in March gained 2 per cent over sales in February and 3 per cent over March last year, according to a report of the Foundry Equipment Manufacturers association. The sales in March totaled $483,010 as compared with $472,814 in February and $467,441 in March, 1925. Shipments for the month were valued at $525,655 as compared with $422,004 in February and $364,334 the corresponding month a year ago. The gain in shipments in March over the same month in 1925 was 44 per cent. Orders on hand April 1 were valued at $504,671 as compared with $536,978 in March 1 and $539,539 on April 1, 1925. Orders on hand April 1 were 6 per cent less than at the same date a year ago.

Exports of foundry and molding equipment in March showed a marked increase, according to a report of the department of commerce. The value of exports in March was $51,735 as compared with $27,083 in February and $49,951 during March, 1925. The value of exports for the nine months ended March 31 was $456,326 as compared with $440,461 during the corresponding period a year ago.

CHICAGO MARKET

CORE MACHINES

Cummings Casting Co., Chicago, one; from the J. S. McCormick Co., Pittsburgh.

DUST ARRESTER EQUIPMENT

Geo. H. Smith Steel Casting Co., Milwaukee; from the Pangborn Corp., Hagerstown, Md.

Crown Iron Works, Minneapolis; Allis Chalmers Mfg. Co., Milwaukee; from the W. W. Sly Mfg. Co., Cleveland.

FURNACES

Ferguson & Lange Foundry Co., Chicago, cupola; Arcade Mfg. Co., Freeport, Ill., cupola; from the Whiting Corp., Harvey, Ill.

MOLDING MACHINES

American Radiator Co., Kansas City, Mo.; seven from the Herman Pneumatic Machine Co., Zelienople, Pa.

SANDBLAST EQUIPMENT

Kainer & Co., Chicago, cabinet; from the W. W. Sly Mfg. Co., Cleveland.

SAND PREPARING EQUIPMENT

American Brake Shoe & Foundry Co., Melrose Park, Ill.; Green Engineering Co., East Chicago, Ind.; Liberty Foundry Co., Rockford, Ill.; William E. Pratt Mfg. Co., Joliet, Ill.; Hansell-Elcock Co., Chicago; Household Utilities Co., Chicago; Lavelle Foundry Co., Anderson, Ind.; sand separators and blenders from Royer Foundry & Machine Co., Wilkes-Barre, Pa.

National Malleable & Steel Castings Co., Chicago; Western Electric Co., Chicago; International Harvester Co., Rock Island, Ill., two; Frank Foundries, Moline, Ill.; sand mixers from National Engineering Co., Chicago.

Saginaw Products Co., Saginaw, Mich., core sand reclaiming, from the W. W. Sly Mfg. Co., Cleveland.

SHAKEOUT EQUIPMENT

Holland Furnace Co., Holland, Mich., core knockout machine; from the Stoney Foundry Engineering & Equipment Co., Cleveland.

Columbia Sanitary Mfg. Co., Louisville, Ky.; the Pullman Car & Mfg. Co., Pullman, Ill., vibrator and shakeout equipment; from the Stoney Foundry Engineering & Equipment Co., Cleveland.

TUMBLING BARRELS

Lindgren Foundry Co., Batavia, Ill., one; Belle City Mfg. Co., Racine, Wis., one; International Harvester Co., Chicago, six; from the Whiting Corp., Harvey, Ill.

NEW YORK MARKET

CRANES

James McKinney & Son, Albany, N. Y.; one 10-ton from the Northern Engineering Works, Detroit.

Honolulu Iron Works, N. Y., two; from the Whiting Corp., Harvey, Ill.

General Electric Co., Baltimore; from the J. W. Paxson Co., Philadelphia.

FURNACES

M. W. Kellogg & Co., Jersey City, N. J., 3-ton electric; from the Pittsburgh Electric Furnace Co., Pittsburgh.

A. P. Smith Mfg. Co., East Orange, N. J., cupola; from the J. W. Paxson Co., Philadelphia.

LADLES

Globe Malleable Iron & Steel Co., Syracuse, N. Y.; Lincoln Radiator Co., Utica, N. Y.; from the J. W. Paxson Co., Philadelphia.

Fell Machine & Foundry Co., Ogdensburg, N. Y., one worm geared; from the J. S. McCormick Co., Pittsburgh.

SANDBLAST EQUIPMENT

Jefferson Union Co., Inc., Lockport, N. Y.; from the W. W. Sly Mfg. Co., Cleveland.

Snapp Foundry Co., Winchester, Va.; from the Pangborn Corp., Hagerstown, Md.

Pfaudler Co., Rochester, N. Y.; from the J. W. Paxson Co., Philadelphia.

SAND PREPARING EQUIPMENT

Gould Coupler Co., Depew, N. Y., Hart & Crouse Co., Utica, N. Y.; sand mixers from the National Engineering Co., Chicago.

Brooklyn Vault Light Co., Brooklyn, N. Y.; Garrone Foundry, Turino, Italy; sand separator and blender from the Royer Foundry & Machine Co., Wilkes-Barre, Pa.

SHAKEOUT EQUIPMENT

New York Air Brake Co., Watertown, N. Y., vibrator and shakeout equipment; from the Stoney Foundry Engineering & Equipment Co., Cleveland.

TUMBLING BARRELS

Poughkeepsie Foundry & Machine Co., Poughkeepsie, N. Y., three; from the W. W. Sly Mfg. Co., Cleveland.

CLEVELAND MARKET

DUST ARRESTOR EQUIPMENT

Dayton Engineering Laboratories, Dayton, O.; from the W. W. Sly Mfg. Co., Cleveland.

Packard Motor Car Co., Detroit; from the Pangborn Corp., Hagerstown, Md.

FURNACES

Sterling Foundry Co., Wellington, O., for core oven; from the Mayor Fuel Saving Furnace Co., Cleveland.

LADLES

Paper & Textile Machine Co., Sandusky, O., one; from the Whiting Corp., Harvey, Ill.

MOLDING MACHINES

Michigan Valve Foundry Co., Detroit, one; from the Herman Pneumatic Machine Co., Zelienople, Pa.

SANDBLAST EQUIPMENT

Dayton Engineering Laboratories, Dayton, O., from the W. W. Sly Mfg. Co., Cleveland.

Jarecki Mfg. Co., Erie, Pa.; the Maumee Malleable Castings Co., Toledo; from the Pangborn Corp., Hagerstown, Md.

SAND PREPARING EQUIPMENT

American Radiator Co., Buffalo, continuous mixer; from the Standard Sand & Machine Co., Cleveland.

Central Specialty Co., Detroit, sand mixer from the National Engineering Co., Chicago.

Bunting Brass & Bronze Co., Toledo; Seybold Machine Co., Dayton, O.; Kilby Mfg. Co.,

Cleveland; Star Foundry Co., Troy, O.; Superior Gas Engine Co., Springfield, O.; Holmes Foundry Co., Ltd., Sarnia, Ont.; sand separators and blenders from the Royer Foundry & Machine Co., Wilkes-Barre, Pa.

SHAKEOUT EQUIPMENT

Ferro Machine & Foundry Co., Cleveland, vibrator and shakesout equipment from the Stoney Foundry Engineering & Equipment Co., Cleveland.

TUMBLING BARRELS

Dodge Bros., Detroit, three; Unit Stove & Furnace Co., North Birmingham, Ala., two; Westinghouse Electric & Mfg. Co., Cleveland, two; James B. Clow & Son, Newcomerstown, O.; Crane Ltd., Montreal, Que.; Grabler Mfg. Co., Cleveland, from the W. W. Sly Mfg. Co., Cleveland.

MISCELLANEOUS

Dayton Malleable Iron Co., Ironton, O., cinder mill from the W. W. Sly Mfg. Co., Cleveland.

PITTSBURGH MARKET

CORE MACHINES

Domestic Engineering Co., Shippersburg, Pa., from the J. S. McCormick Co., Pittsburgh.

CRANES

National Radiator Co., New Castle, Pa., one 5-ton; from the Milwaukee Electric Crane & Mfg. Co., Milwaukee.

FURNACES

Roberts & Manders Stove Co., Hatboro, Pa.; Wolf Co., Chambersburg, Pa.; cupolas from the J. W. Paxson Co., Philadelphia.

Cochrane Brass Foundry Co., York, Pa.; the Flood City Mfg. Co., Johnstown, Pa.; one brass furnace each from the J. S. McCormock Co., Pittsburgh.

LADLES

Stockton Pipe Co., Birmingham, Ala., two; from the Whiting Corp., Harvey, Ill.

MOLDING MACHINES

Pittsburgh Engineering Co., Jeannette, Pa.; the Frog & Switch Co., Carlisle, Pa.; from the Herman Pneumatic Machine Co., Zelienople, Pa.

SANDBLAST EQUIPMENT

Athens Foundry Co., Athens, Pa., from the Pangborn Corp., Hagerstown, Md.

SAND PREPARING EQUIPMENT

Bethlehem Steel Co., Bethlehem, Pa., sand separator and blender; from the Royer Foundry & Machine Co., Wilkes-Barre, Pa.

NEW ENGLAND MARKET

CRANES

Mansfield Foundry Co., Mansfield, Mass., tramway crane; from the Cleveland Crane & Engineering Co., Wickliffe, O.

General Alloys Co., South Boston, Mass.; from the Shepard Electric Crane & Hoist Co., Montour Falls, N. Y.

Mansfield Foundry Co., Mansfield, Mass., three small electric overhead cranes; from the Shepard Electric Crane & Hoist Co., Montour Falls, N. Y.

SANDBLAST EQUIPMENT

Union Mfg. Co., New Britain, Conn.; Hartford Foundry Co., Wethersfield, Conn.; from the Pangborn Corp., Hagerstown, Md.

SAND PREPARING EQUIPMENT

General Electric Co., Lynn, Mass.; Bradley & Hubbard, Meriden, Conn.; sand separator and blender from the Royer Foundry & Machine Co., Wilkes-Barre, Pa.

General Electric Co., Lynn, Mass., sand mixer; from the National Engineering Co., Chicago.

United Metal Mfg. Co., Norwich, Conn.; Gibby Foundry Co., East Boston, Mass.; sand separators and blenders from the Royer Foundry & Machine Co., Wilkes-Barre, Pa.

TUMBLING BARRELS

Crompton & Knowles Loom Works, Worcester, Mass.; two from the Whiting Corp., Harvey, Ill.

What the Foundries Are Doing

Activities of the Gray Iron, Malleable, Steel and Brass Shops

Werntz Foundry & Machine Works, Warsaw, Ind., recently suffered an $8,000 fire loss.

Chicago Foundry Co., Chicago, is building a new addition. It is expected to be completed in two months.

Service Pattern Shop, Racine, Wis., is building an addition to its shop and will occupy it soon.

Seattle-Astoria Iron Works Co., Seattle, has let contract to Murdock & Eckman for addition 107 x 120 feet.

South Side Foundry Co., 2900 South Washington street, Peoria, Ill., is having plans drawn for a 2-story foundry 60 x 80 feet.

Appleton Iron & Brass Co., Appleton, Wis. A. Weise manager, 1704 East John street, will build a 1-story shop 60 x 100 feet.

Michaels Art Bronze Co., 236 Scott street, Covington, Ky., is having plans made for an addition to its plant.

Millville Iron Foundry, Millville, N. J., is having plans made for rebuilding its burned plant.

M. & N. Pattern Works, 448 North Halsted street, Chicago, will build a plant at 1461 West Grand avenue, 50 x 110 feet.

Oklahoma Steel Castings Co., Tulsa, Okla., Ernest H. Cornelius president, has plans for a new plant at Houston, Tex., including foundry, pattern shop and pattern storage.

Quality Aluminum Casting Co., Waukesha, Wis., will build a plant addition 80 x 280 feet, for which cranes and equipment will be required.

C. C. Collins Co., 250 Poplar street, Memphis, Tenn., manufacturer of hoisting machinery and devices, is considering plans for a 1-story foundry and machine shop.

Hartford Foundry Corp. has started operations in the former plant of the National Machinery Co., Wethersfield, Conn. Edgar Spencer, formerly superintendent of the Connecticut Foundry Co., at Rocky Hill, Conn., heads the new company.

Houston Steel & Foundry Co., Houston, Tex., will proceed at once to build a steel foundry and pattern shop 96 x 100 feet for the first unit to be followed immediately by a second unit 136 x 425 feet. The plant will be on the site of the former Southern Motors association works and several of the existing structures will be utilized.

Phelan Brass & Machine Co., New York, has been incorporated with $10,000 capital by J. H. Curtiss, B. Robb and H. J. Exler. S. Ladden, 233 Broadway, is attorney.

Kydd Furnace Mfg. Co., Seattle, has been incorporated with $5000 capital by Norman C. Kydd, Grover E. Desmond and Stanley J. Meehan.

Longview Foundry & Mfg. Co., Longview, Wash., F. R. Faller manager, will build a pattern shop and office building 88 x 100 feet.

American Radiator Co., Buffalo, has let contract to the Crea Construction Co. for a 1-story addition to its Bond plant, 150 x 200 feet, for use as a foundry.

Grand Haven Brass Foundry, Grand Haven, Mich., 618 Lafayette street, will build a 2-story addition. A. E. Jacobson is general manager.

Los Angeles Brass Foundry, Los Angeles, has let contract to Brombacher Iron Works to build 1-story shop building at 1531 Crompton avenue.

American Sashweight Co. of Pennsylvania, Coatesville, Pa., has been incorporated with $22,000 capital to manufacture castings, by O. T. Smith, Charles F. Humpton and C. T. Smith.

Hi-Test Bronze Die Casting Co., Chicago, has let contract to G. Kehl Sons, 1225 North Maplewood avenue, for a 2-story plant 63 x 113 feet at 900 North Spaulding avenue. (Noted April 15).

Chemung Foundry Corp., Elmira, N. Y., has increased its capital from $50,000 to $100,000.

John East Iron Works, Avenue C., Saskatoon, Sask., proposes to build addition to foundry here.

Southern Wheel Co., Commonwealth building, Pittsburgh, has let contract to Cornet-Casey Co., Chemical building, for a foundry building 230 x 420 feet at St. Louis. (Noted March 1.)

Automotive Pattern Co., Detroit, has been incorporated to manufacture metal and wood patterns, with $24,000 capital, by Oscar Barkenowitz, 2930 Field avenue, Howard E. Hoffman and Edwin A. Fleming.

International Harvester Co., Cyrus H. McCormick chairman, 606 South Michigan avenue, Chicago, has let contract to the Austin Co., 160 North LaSalle street, Chicago, for a 1-story addition 90 x 160 feet at Canton, Ill.

Burnham Boiler Corp., Irvington, N. Y., is having plans made for a 2-story branch factory and distributing plant 55 x 100 feet in Queens Village, L. I. Alexander McLean, 149 Jamaica avenue, Jamaica, L. I., is architect.

Superior Pattern & Mfg. Co., Detroit, has been incorporated to manufacture patterns and general machine work, with $60,000 capital, by Robert G. Schram, 3954 Seyburn avenue, Theodore Trefzer and William H. Sigsworth, Royal Oak, Mich.

Aluminum & Brass Foundry Co., Chicago, has been incorporated with $30,000 capital to manufacture brass and aluminum articles by Joseph N. Mashken, Joseph N. Eisminski, and Paul Pilkis. Kassimir P. Gugis, 127 North Dearborn street, is correspondent.

Gerstein & Cooper Co., Boston, has been incorporated with $75,000 capital to carry on a general foundry and machine shop and manufacture castings by Maurice Gerstein president, Abraham Cooper, 7 Benton street, Dorchester, Mass., treasurer, and Benjamin A. Levy clerk.

Freeman Boiler & Engineering Co., 53 West Jackson boulevard, Chicago, has been incorporated with $5000 capital to manufacture heating and power plant equipment and steam fittings by Robert S. Redfield, Robert W. Thompson and Lillian Fisher. Redfields, 53 West Jackson boulevard, are correspondents.